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Report No. 3

A Prospective Reimbursement System Based on Patient Case-Mix for New Jersey Hospitals, 1976-78

Department of Health, Education & Welfare • Health Care Financing Administration

ABSTRACT

Under SSA Contract No. 600-77-0022, the New Jersey State Department of Health is developing a system of prospective reimbursement for hospitals based on their patient case-mix. This endeavor begins with the classification of inpatients into homogeneous typologies referred to as "Diagnosis Related Groups" (DRGs). These DRGs furnish the foundation for a common yardstick or denominator previously lacking to hospital regulatory agencies, thereby facilitating the development of a quasi-public utilities model for hospital rate-setting.

Since January 1, 1976, the Department of Health has been receiving medical discharge abstracts from all 118 acute care hospitals in the state. Selected variables from these discharges are used to categorize cases into 383 medically meaningful and statistically stable DRGs by means of a patient classification scheme referred to as "AUTOGRP" (pronounced Autogroup).

A second phase of the Project has involved the allocation of patient care costs to DRGs for 21 voluntarily participating hospitals. In order to apply costs to the DRGs, functionally grouped cost data (as obtained from New Jersey's present peer grouped based rate-setting method, Standard Hospital Accounting and Rate Evaluation System - SHARE) are allocated to patients based on various statistics, e.g., for ancillary services, the ratio of cost to charges is used; for nursing services, weighted statistics reflecting relative intensities of nursing needs and services are being developed; for patient care general services such as dietary services, alternate statistics for apportionment are under development. In early 1978, certain participating hospitals will have the option of selecting their rates set through SHARE, or a rate based on case-mix for patient care costs and a peer-group based method for institutional costs. In order to test this case-mix model throughout the state, the Project is currently implementing steps to obtain the necessary statisitics, such as charge data through the uniform billing reporting regulation.

The raison d'etre for this system of common denominators is to move hospital reimbursement from its current per diem reasonable cost basis to a cost per case incentive approach, thereby encouraging better hospital management. The model will provide basic management information to hospital administrators. DRGs also may be used as a framework to assess the relationships among quality, costs and accessibility of patient care. In this respect, these common denominators may provide the basis for planning the proper allocation of limited health care resources to meet the needs of a region's population.

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Volume I

A Prospective Reimbursement System Based on Patient Case-Mix For New Jersey Hospitals 1976-1978

Annual Report

November 20, 1977

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Contract Number: 600-77-0022

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I. INTRODUCTION

A. Background

Whenever the legislature decides that an aspect of an industry must be subject to regulation in order to further or protect the public interest, the regulatory agency and the regulated industry must have common measures of performance upon which to base their decisions. Where traditional public utilities are involved, such measures already exist (e.g., cost per kilowatt hour, per cubic foot of natural gas, per gallon of water). These measures permit the Agency and the industry to assess performance in an objective way, namely, to determine the cost-benefit of current activities or the undertaking of new projects. In addition, these measures provide the basis for developing objective quality criteria. However, in the case of the health care industry, a newcomer to the group of regulated industries, common measures of performance have not yet been developed. The purpose of this Project is to develop such common denominators for the hospital sector of the health care industry.

Despite the lack of such common denominators, the tools of traditional utility regulation have been applied to hospital rate-setting in New Jersey and elsewhere. Institutional cost centers are grouped into "homogeneous" classes according to some set of characteristics (e.g., size, service area, etc.) in much the same way the performance of one water company is compared to standards set by its peers. However, water companies supply only water, and the application of this rather straightforward technique, peer grouping, has been met with frustration in an industry where the kinds and amounts of services demanded and provided vary not only between instututions, but among individual consumers. For instance, the resources which a hospital must devote to treating an adolescent with appendicitis differ significantly from those which must be applied to an elderly cancer patient. Therefore, it is not surprising that in rate reviews and appeals individual institutions complain that methods of establishing fairness are not sufficiently sensitive to the unique set of circumstances faced by their particular institution.

In New Jersey, a state where 118 acute care hospitals treat over 1,000,000 patients per year, considerable progress has been made in addressing the obvious institutional differences between an inner-city, major teaching institution with over 400 beds, and a rural 100 bed hospital. SHARE, Standard Hospital Accounting and Rate Evaluation System, the peer grouping methodology employed by this Department, has gone through successive waves of refinement since the first year of its application in 1975. However, the fact that only by coincidence would two institutions treat the same mix of cases has given birth to this Project. In order for the State to discharge its obligations to both the public and the

institutions, a common denominator must be developed which permits meaningful comparisons among hospital with varying complexities of case-mix.

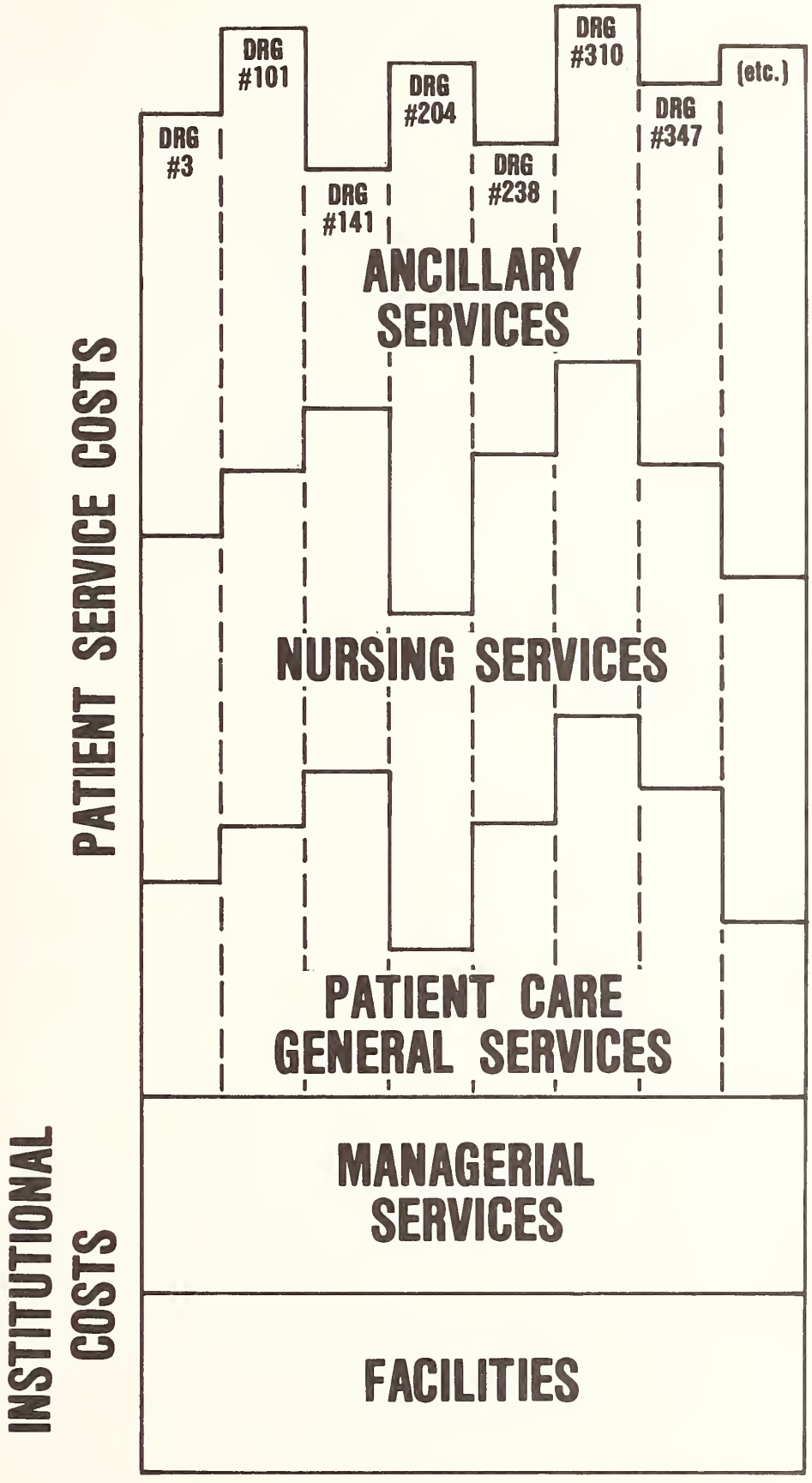
AUTOGRP (pronounced Autogroup) is a system for classifying various patient cases into categories which are both medically meaningful and statistically homogeneous. This computer application examines the statistical significance of certain variables such as a primary diagnosis, secondary diagnosis, age, primary surgery, and secondary surgery in order to partition 83 major disease classifications into 383 Diagnosis Related Groups (DRGs). (A comprehensive description of this process is presented in Section II.A.) DRGs were originally developed to increase the effectiveness of utilization review. For example, under more primitive systems which looked only to primary diagnosis, a reviewer considering length of stay in the case of a broken limb would not have the benefit of a system which identified differing lengths of stay by adjusting cases for age or other variables which may exert a significant influence on length of stay. (In essence, the difference between the old and new is two dimensional classification versus three dimensional.) Thus, for utilization review purposes, a classification scheme has already been developed which examines a mass of statistical data, evaluates the relative significance of different variables in explaining length of stay, and arrives at a medically meaningful group of patients for whom predicted length of stay is stable, thereby providing a reference point from which both reviewer and medical staff might begin their discussions over remaining unexplained differences in length of stay for that group of patients (the DRG).

Under Federal Contract SSA 600-77-0022, this Project is charged with examining whether this system of common denominators might serve as a basis for establishing reasonable rates of reimbursement through a marriage of financial data to medical data. It is worthy of note that in adapting these common denominators for reimbursement, the process proceeds from the direction opposite to that previously described. Thus, for utilization, the process formerly involved taking a large universe of apparent differences (over 1,000 different diagnoses), and discovering which variables actually explain many differences in lengths of stay (LOS), and arriving at a level of detail which was both appropriate to the problem involved and manageable. With respect to reimbursement, the process involves starting with an oversimplified methodology - peer grouping - which fails to explain many differences in hospital's costs; then a sufficient amount of relevant detail consonant with the complexity of the problem is added. This process results in an innovative perspective: whereas it may have been totally appropriate to compare gas turbine to gas turbine in order to evaluate relative kilowatt efficiency, the same principle may not obtain when comparing laboratory to laboratory or

radiology department to radiology department among hospitals possessing apparently similar characteristics in terms of size, location, etc. This is because it is the patient and his particular problem which are the focus of decision-making in a hospital. In the management of the patient's problem, a series of demands may be made on laboratory and radiology, as well as dietary, nursing and other services. Instead of a comparison of departments across institutions, a horizontal comparison, it is more appropriate in the patient care area to look vertically and compare the total amount of reasources from various departments which are consumed in the treatment of a given kind of case.

Since both institutional and patient care costs coexist within any given hospital, early efforts of the Project were devoted to identifying and separating out those costs which should be examined using the DRG (vertical) methodology, as opposed to those costs more appropriately left to peer comparison (horizontal). The diagram in Figure 1, which appeared in simpler form in the Third Quarter Report, is illustrative.

FIGURE 1: Hospital Care Costs in New Jersey



B. Report Format

Under the original Request for Proposal (RFP), the scope of work for this Project was set forth by individual tasks. At the beginning of each section in Part II, "A Prosepctive Reimbursement System Based on Patient Case-Mix," an "Overall Milestone Chart" depicts those tasks which are associated with the section which follows. At the end of each section, more detailed Milestone Charts reflect progress on individual activities organized by task and grouped under Project responsibility categories.

Part II of this report describes how Project staff is developing the system for reimbursement based upon DRGs. It is organized as follows: Section A, "Introduction to Diagnosis Related Groups," provides basic background on the DRG system for classifying patients and describes the actions taken to form Diagnosis Related Groups for New Jersey using over 1,000,000 New Jersey medical abstracts. Section B, "Allocation of Costs to Diagnosis Related Groups," discusses the three different sets of statistics being developed for DRG related ancillary costs, nursing costs, and certain patient care related general costs (such as dietary costs). Also discussed is the relationship Project staff hopes to establish between the DRG analysis and the peer-grouping technique. Section C, "Application of DRGs to Planning," is devoted to the implications which such a common denominator has for different parties including financial managers, planners, PSROs, and physicians. Considered in Section C is the potential interrelation between DRG reimbursement and health care planning considerations: quality, economics, and accessibility. Section D, "Data Processing and Testing," addresses the issues of reliability and validity. Wherever appropriate, each new section is preceded by a version of Figure 1 designed to help orient the reader to the aspect of the methodology being considered.

It is important to note that this process does not result in the identification of actual costs per patient or per DRG; this is one of cost allocation rather than direct observation and measurement of costs. The cost per case which is established on the basis of statewide numbers will result in a norm or goal. Over time the parties will react to differences by identifying and undertaking further refinement in either the methodology or the hospital budget. Early next year, this process will begin with a group of New Jersey hospitals which have voluntarily submitted the data necessary to allocate costs to DRGs. These institutions will be offered the option of selecting a rate computed using as a base the methodology set forth below, or the standard SHARE rate.[1]

---

1. A description of these institutions is provided in Table 1.

A continuing dialogue with representatives of these institutions[2] has been invaluable to the participants and sponsors[3] of this Project in obtaining criticism and avoiding many pitfalls. The dialogue has helped us understand that in order to realize the maximum benefit from this kind of methodology, certain complementary changes in the regulatory structure must occur. For example, cost-based reimbursement creates an environment for hospital financial management teams which encourages them to maximize cost rather than efficiency. The current incentive must be reversed in order to give these teams a sound financial reason for acting in the areas of potential efficiency which the methodology identifies. The preliminary thoughts on these matters which are offered throughout and summarized in the "Conclusion" are intended to help move this dialogue forward.

---

2. The participants in this Project are the New Jersey State Department of Health, Division of Health Planning and Resources Development, Health Economics Services, DRG Project, and its subcontractors, Puter Associates and Haskins and Sells.

3. The United States Department of Health, Education and Welfare, Health Care Financing Administration.

TABLE 1:
List of Participating Hospitals

HOSPITAL NAME	LICENSED BEDS	CITY	COUNTY
Atlantic City Medical Center	487	Atlantic City	Atlantic
Cooper Hospital	541	Camden	Camden
Dover General Hospital	360	Dover	Morris
Freehold Area Hospital	165	Freehold	Monmouth
Garden State Hospital	204	Evesham Township (Marlton)	Burlington
Hamilton Hospital	113	Hamilton Township	Mercer
Hospital Center at Orange	391	Orange	Essex
Hunterdon Medical Center	200	Flemington	Hunterdon
Mercer Medical Center	321	Trenton	Mercer
Millville Hospital	134	Millville	Cumberland
Monmouth Medical Center	501	Long Branch	Monmouth
Morristown Memorial Hospital	541	Morristown	Morris
Newark Beth Israel Medical Center	525	Newark	Essex
Overlook Hospital	506	Summit	Union
Passaic General Hospital	312	Passaic	Passaic
Perth Amboy General Hospital	493	Perth Amboy	Middlesex
Rancocas Valley Hospital	308	Willingboro	Burlington
St. Elizabeth Hospital	325	Elizabeth	Union
St. Michael's Hospital	456	Newark	Essex
United Hospitals Medical Center	524	Newark	Essex
West Jersey Hospital	663	Camden	Camden

SECTION II

A. Introduction to Diagnosis Related Groups (DRGs)

1. Diagnosis Related Groups

2. Death and Outliers

3. Case-Mix Reports

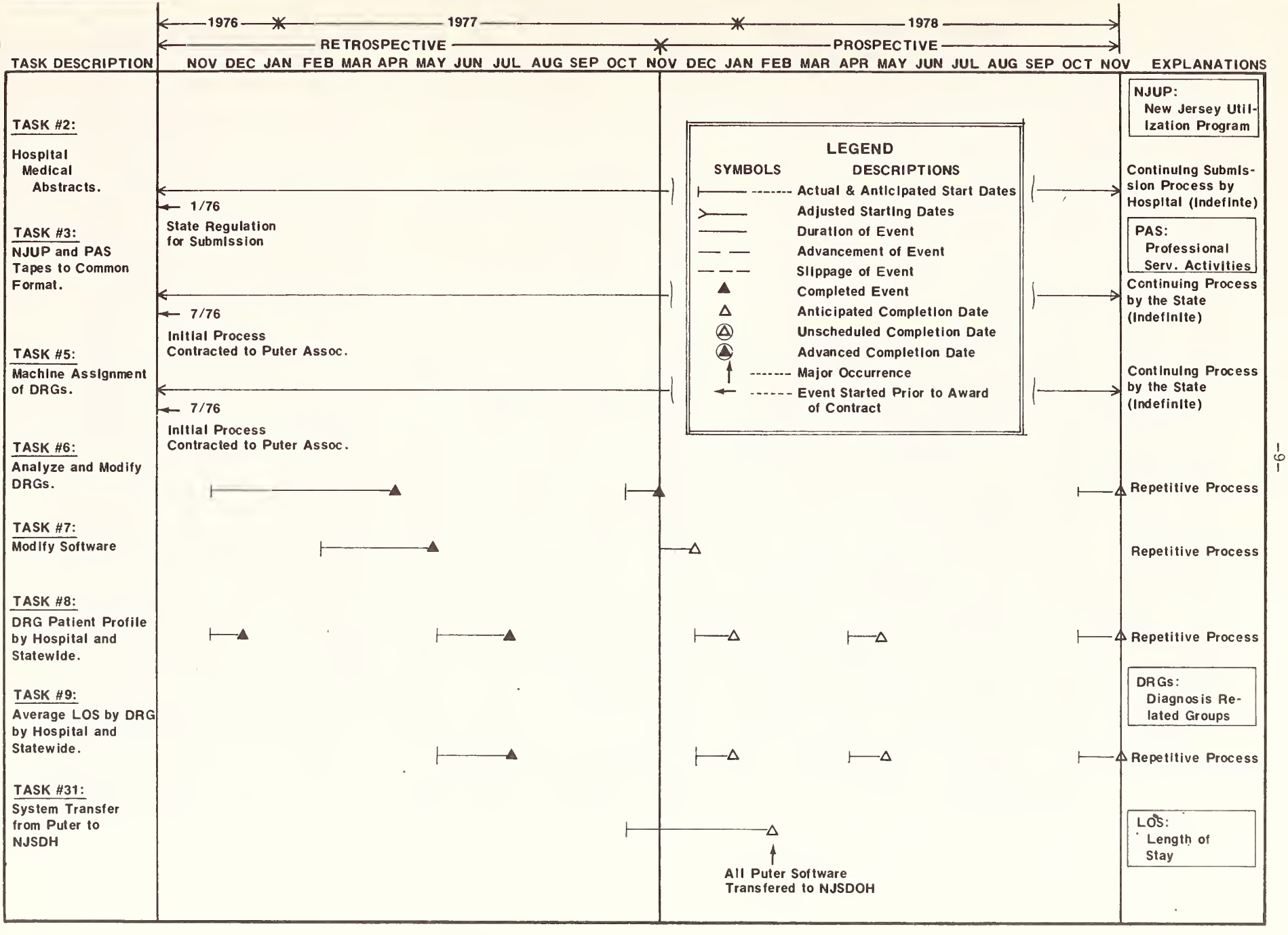
4. Reassessing the Diagnosis Related Groups (DRGs)

5. Medical Abstracts

CHART 1:

Case-Mix Introduction

Introduction to Case-Mix Methodology



II. A PROSPECTIVE REIMBURSEMENT SYSTEM BASED ON PATIENT CASE-MIX

A. Introduction to Diagnosis Related Groups (DRGs)

At the core of the reimbursement system being developed by this Project is the concept of "case-mix." Hospitals treat patients which differ with respect to age, sex, income, education, medical problems, etc.; and the patients may be grouped in various ways to identify unique qualities of the patient population of individual hospitals. For example, if an agency were examining variations in the severity of hospitals' indigency problems, an "income-mix" could be established for the patient population of each hospital under study. This income-mix could be based on the distribution of family income within the community and other economic considerations (e.g., family income weighted by owning or renting a home). The calculated income-mix might be used as an indicator of the percentage of indigent patients each hospital could expect each year. In short, there are many ways to slice the data to examine different cross sections of hospitals' patient populations.

For purposes of global hospital reimbursement, the identification of classes of patients for whom consistent, stable, and reliable patterns of resource consumption can be predicted during a typical hospital stay is important. For example, both the types of resources used and the cost of these resources are very different for cancer patients and maternity patients. Accordingly, one would expect a hospital treating 80% cancer patients and 20% maternity patients to cost more to operate than a hospital treating 80% maternity patients and 20% cancer patients (assuming similar patient volumes). The reimbursement of these two hospitals should reflect this difference in the types of patients treated -- this difference is case-mix. (Refer to Chart 1 for those Tasks which identify case-mix by DRGs.)

In this Project, the basic building block of case-mix is the Diagnosis Related Group (DRG). The DRGs concept, its development, refinement for use in the State of New Jersey, and certain problems and/or opportunities which arise due to the presence of unexplained variation (i.e., "outliers"), are discussed in this Section. In Section II.B which follows, the three different methodologies which have been developed to allocate patient care costs of ancillary services, nursing, and patient care general services to the various DRGs are discussed. Section II.B also presents the proposed treatment to be given to institutional costs through the use of peer grouping and the Economic Factor to be applied to global budgets. In Section II.C., "Application of DRGs to Planning," the application of costed DRGs to the health care planning

considerations of quality, economics, and accessability is reviewed (i.e., the linkage between planning and reimbursement). Finally, Section II.D., "Data Processing and Testing," deals with specific data processing and analysis issues involved with developing the use of DRGs for reimbursement.

1. Diagnosis Related Groups (DRGs)

The specific case-mix classification scheme used in this Project is based on the Diagnosis Related Group (DRG) concept. Any patient can be classified into one, and only one, DRG based on criteria such as primary diagnosis, secondary diagnosis, primary procedure, secondary procedure, and age. A particular diagnosis related group consists of patients with both similar clinical characteristics and similar resource consumption characteristics. Three hundred and eighty-three DRGs were established based on New Jersey data. The medical abstract data base used to establish the DRGs will be discussed at the end of this section. The basic method for deriving the DRGs is as follows:

First, the universe of medical diagnoses was clustered by clinicians into 83 broad, mutually exclusive categories. These "major diagnostic categories" were established so that they:

- were consistent in terms of their anatomical, physio-pathological classification, or in the manner in which they are clinically managed.
- contained a sufficient number of patients.
- covered the complete range of diagnoses without overlap.

A clinician using AUTOGRP[4] then partitioned each major diagnostic category into discrete diagnosis related groups (DRGs) which are both medically meaningful and statistically well behaved. As an example of the partitioning process, Figure 2 shows the length of stay distribution for patients in major diagnostic category 68, "Diseases of Bone and Cartilage."

---

4. AUTOGRP (pronounced Autogroup), is a computer system allowing interactive statistical analysis. The key capacity of AUTOGRP is its ability to partition data (patients' medical abstracts in this case) in order to maximally explain variation in a dependent variable (e.g., length of stay) as a function of a given set of independent variables (patients' age, sex, diagnoses, procedures, etc.). See Section II.D. for a more detailed discussion of AUTOGRP.

Using AUTOGRP, this distribution was statistically partitioned a number of times using different predictor variables such as primary diagnosis, secondary diagnosis, primary procedure, secondary procedure and age; other variables were originally included, but these five explained the most variance in almost all partition processes. Based on these computer generated partitions, the clinician decided that the presence or absence of surgery resulted in the most significant grouping given both statistical and medical criteria. This partition is shown in Figure 3.

In the next step, an examination of each new distribution was then performed to determine whether or not further partitioning was appropriate. Again, AUTOGRP statistically partitioned each of the distributions several times using the different predictor variables until the clinician was able to determine the most appropriate final set of partitions. The "no surgery" group was finally partitioned into two groups based on specific primary diagnoses. The surgery group was finally partitioned into these groups based on specific procedures. Figures 4 and 5 show these partitions. Each of these five groups was examined further to determine if additional partitioning was appropriate. In this instance, no further partitioning resulted in more explanation of variance. Figure 6 shows a tree diagram of the final partitioning. The final five partitions represent five DRGs derived from one Major Diagnostic Category.[5]

Administering this technique to over 500,000 discharge abstracts from the first two quarters of 1976 from New Jersey hospitals, a new set of DRGs was developed. This AUTOGRPing resulted in 383 DRGs using a partitioning scheme to accommodate both ICDA-8 and HICDA-2 codes.[6]

---

5. Detailed definitions of all DRGs, including tree diagrams of their derivations, are available upon request. Refer to AUTOGRP Patient Classification Scheme for Length of Stay (New Haven, 1977).

6. The original contract simply involved the adaption of 317 DRGs developed using data from Connecticut to New Jersey. This approach proved too cumbersome due to New Jersey's use of both ICDA-8 and HICDA-2 coding schemes as opposed to Connecticut's single ICDA-8 scheme. Since there is no one-to-one match for every HICDA-2 to ICDA-8 code, the New Jersey data was completely re-AUTOGRPed.

FIGURE 2:

Length of Stay Distribution for Category 68, "Diseases of Bone and Cartilage"

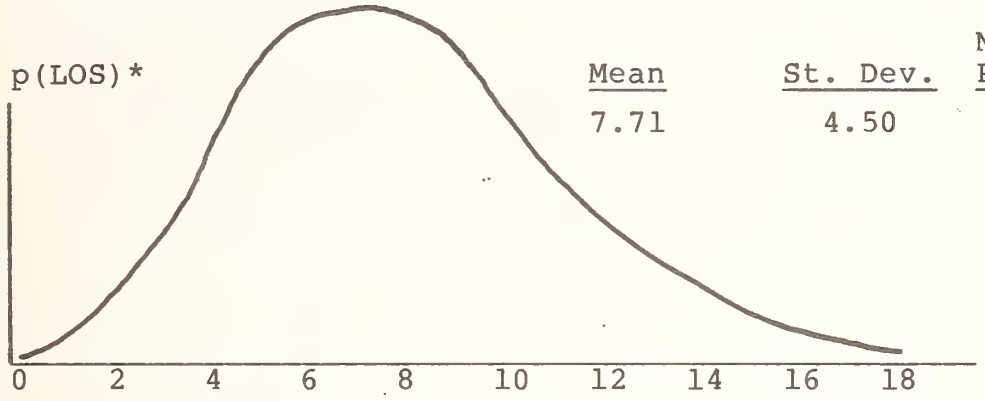
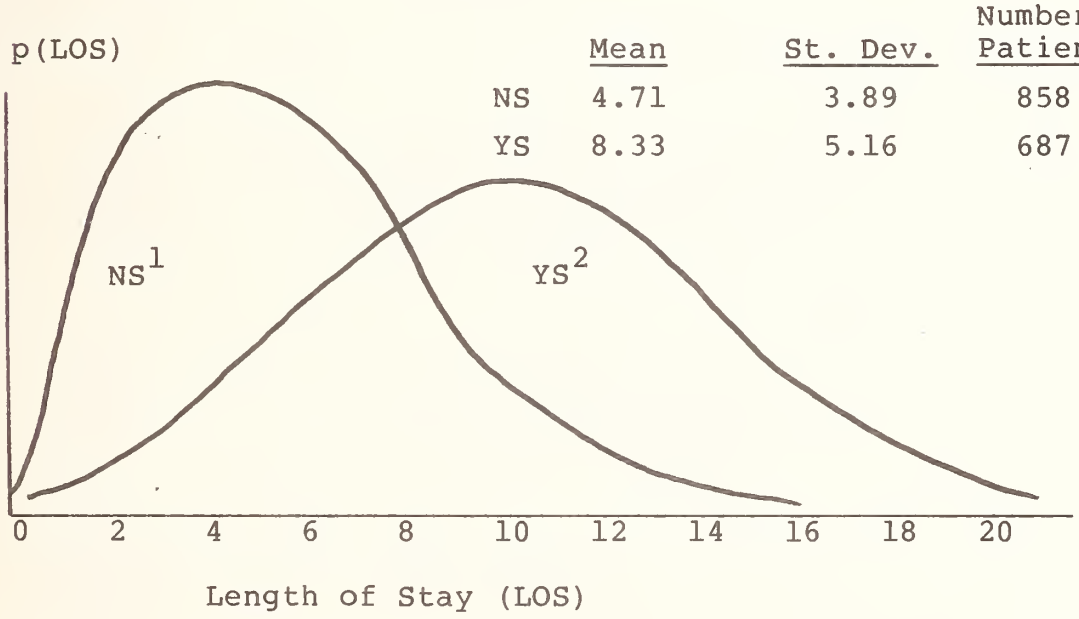


FIGURE 3:

Partitioning on Presence or Absence of Surgery



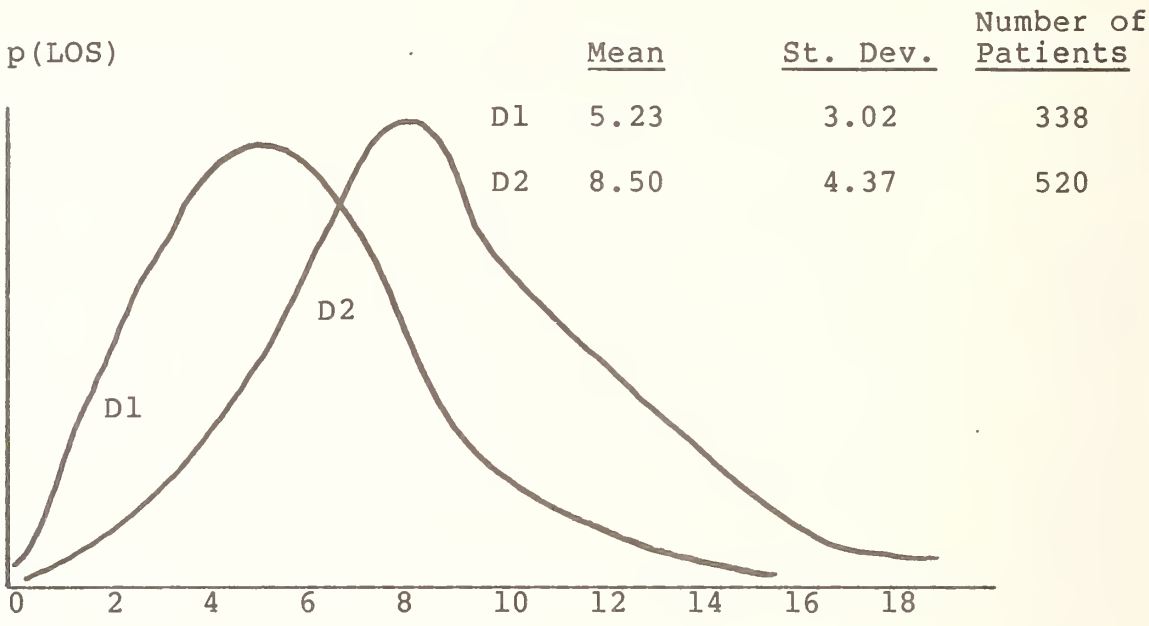
1) "No Surgery" (patients with no surgery performed)
2) "Yes Surgery" (patient with surgery performed)

---

* p(LOS) = probability of length of stay

FIGURE 4:

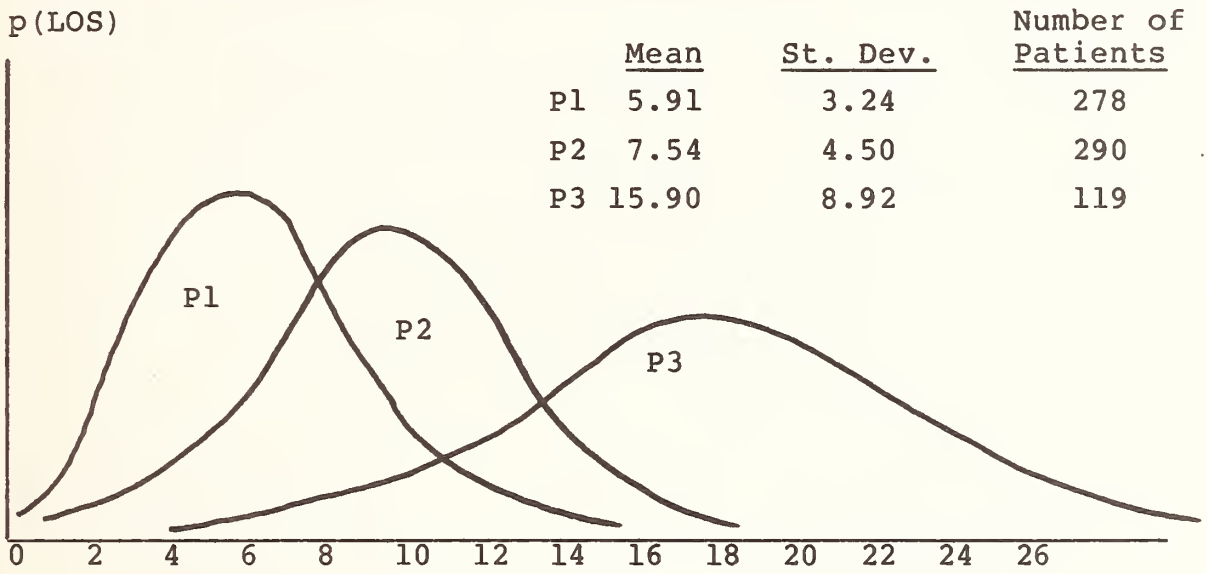
Partitioning of Patients with No Surgery into Two Groups Based on Primary Diagnosis



ICDA-8 Code	Diagnosis
	D1
717.9	Nonarticular Rheumatism NEC
723.5	Costochondritis
724.0	Spinal Derangement NEC
724.6	Knee Derangement NEC
	D2
723.0	Osteoporosis
721.0	Pathologic Fracture
720.2	Osteomyelitis NOS
723.2	Osteitis Deformans

FIGURE 5:

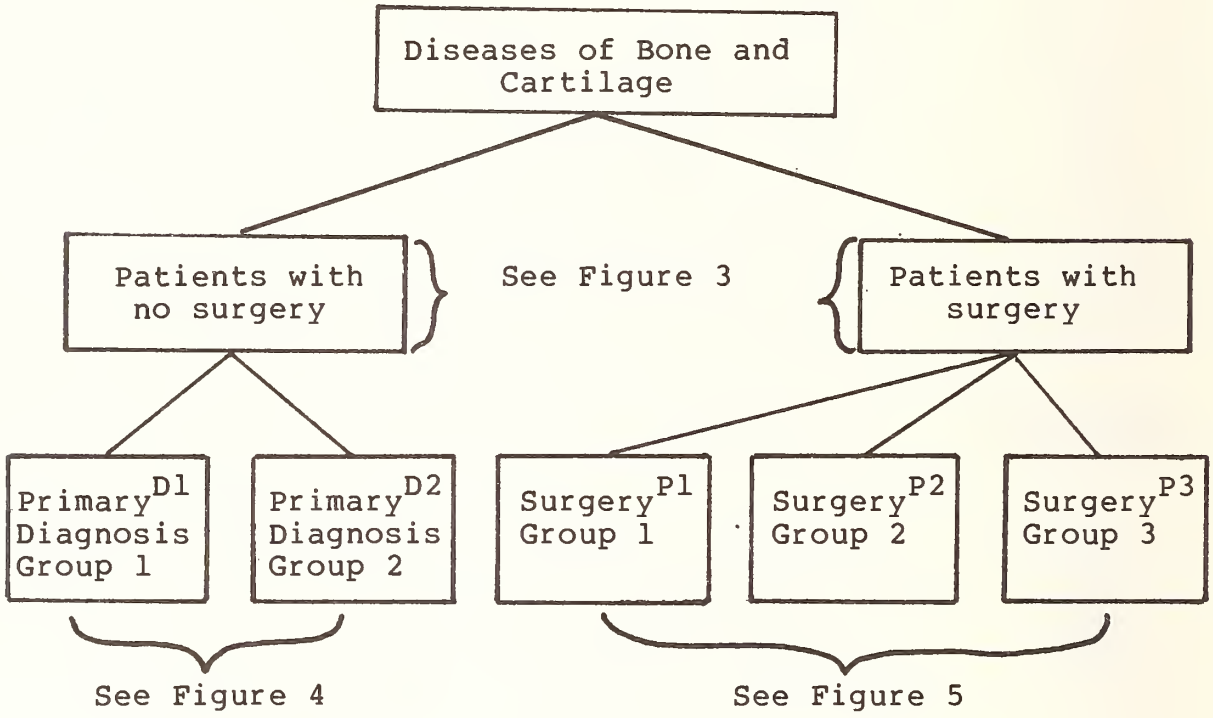
Partitioning of Patients with Surgery by Specific Surgery



ICDA-8 Code	Diagnosis
P1	
80.6	Excise Semilunar Cart-knee
81.8	Arthroplasty of Shoulder
85.0	Joint Manipulation NEC
83.7	Muscle Tendon Transplant
P2	
80.2	Arthrotomy
78.3	Excision Bone Lesion
78.8	Remove Internal Fixation
P3	
81.6	Arthroplasty Hip NEC
84.5	Toe Amputation
81.5	Total Hip Replacement

FIGURE 6:

Tree Diagram of Final Partitioning of Major Diagnostic Category 68



2. Deaths and Outliers

This classification scheme treats two groups of cases differently from other patients. The first group includes all those patients who died in the hospital. Because these patients died, this group tends to utilize hospital resources differently from patients with the same diagnostic, procedural and age characteristics who lived. As a result, deaths are excluded from the AUTOGRP process described in the last section; the DRG definitions were derived for live discharges only. This allows for a more uniform and, thus, more appropriate definition across hospitals. This does not mean that patients who died are not taken into account by the DRG system. Patients who died are assigned to the appropriate DRG in the same manner as live patients: on the basis of diagnoses, procedures, and age. For some purposes, the deaths in a DRG are combined with the live patients in that DRG for analysis; for example, a combined total is used in calculating the difficulty of the case-mix being treated by a hospital. For other purposes, the deaths are treated differently than live discharges in the same DRG; for example, separate calculations are made for live and dead discharges when calculating the average length of stay for a DRG.

The second group consists of patients who were treated differently from the rest, and are called "outliers." Outliers are live discharges whose lengths of stay (LOS) are atypical when compared with all other discharges within a given DRG. For example, in DRG number 1 (enteritis, diarrheal disease with age under 16) there are 550 patients having a LOS under 21 days with a mean LOS of 4.1 days (standard deviation = 2.2). For this DRG, there were 4 patients having a LOS over 20 days with a mean LOS of 46.0 days (standard deviation = 16.1). These four patients are considered outliers and it can be easily seen that their LOS is considerably out of line compared to the other 550 cases in DRG #1 (New Jersey data taken from first six months of 1976). As with the deaths, outliers are assigned to a discrete DRG, and treated separately for some analyses and combined with the non-outliers for others.[7]

The phenomenon of abnormally low LOS outliers constitutes an additional aspect of the outlier problem now being addressed by Project staff. These are more difficult to identify, but the inclusion of abnormally low LOS cases would have the effect of alternating the mean level of resource utilization.

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7. As a note on terminology used in this report and other discussions of DRGs, any patient who is neither an outlier nor a mortality is called an "included" patient.

If a mean LOS for a DRG is 10 days (standard deviation = 2), then a patient with a 1 day LOS would lower the mean LOS even though the case is abnormal. However, most real cases are not this obvious, and identification of low LOS outliers is a problem currently under scrutiny.

Of course, no system of rate-making by itself is able to explain all legitimate variations in cost across all institutions. This is why there are exceptions and appeals. Hopefully, the case-mix approach will provide a "better fit" to the particular cost contours of the health care industry. Outliers which accounted for 10.3% of patient days in the first six months of 1976 but only 1.9% of admissions during the same period, are the frontier. To the degree that these unexplained exceptions represent imprecision in the system of classification, they provide a valuable source of information for the constant process of refinement which the DRGs will undergo. (See Section II.A.4 below, "Reassessing the DRGs.") On the other hand, to the degree that outliers point to problems in the health care delivery system, such as the unavailability of nursing home beds, these aberrations will help many different parties such as planners, regulators and hospital management to focus simultaneously on the location, nature and extent of the problem. (A further discussion of this topic appears in section II.C.1, "Quality.")

3. Case-Mix Reports

With the DRGs defined, they can be used to examine the case-mix of individual hospitals, the State as a whole, individual Health Systems Agency (HSA) areas and any other regionalization that would prove helpful. They are especially useful to hospitals for comparing their case-mix against State profiles, and comparing their LOS efficiency against State norms for each DRG. Such reports are also valuable for health planners in identifying real need areas within the State. For example, certain types and amounts of equipment should be located strategically for treating the patients requiring that care. Regional case-mix reports identify the specific kinds and numbers of patients being treated in that area. There are numerous other uses for these case-mix reports, ranging from departmental anaylses within hospitals to statewide analyses of all groups of patients.

Appendix A (Tasks 8 and 9, item 1) of Puter's Annual Report (Appendix II.A of this report) contains a sample of the case-mix reports which were produced and given to individual hospitals in the State in March, 1977. Every hospital whose data had been submitted by that time received the reports under Tasks 8 and 9. Each hospital received complete documentation, statewide case-mix reports, and three types of case-mix reports representing each hospital's discharges. These reports used data from the first half of 1976. Case-mix reports for all of 1976 were expected in June but were delayed due to problems in receiving data from all hospitals. These reports are now expected to be ready by November, 1977 with the submission of completed data as of October 1, 1977 (with the exception of one independent abstracting hospital which experienced data reliability problems).

Since the statewide and hospital case-mix reports were first generated in February and March 1977 respectively, several changes have been made affecting the statistics reported. These changes included: a) modification of the cutoff points for identifying long LOS outliers for most DRGs (Any patient with a LOS over the cutoff is an outlier.), and b) an identification of certain hospitals to be treated differently from other hospitals due to their specialized nature (e.g., rehabilitation facilities). Appendix I.A.1 contains the revised statewide case-mix report produced by project staff and Appendix I.A.1.a contains a list of English descriptors of the DRGs. The new outlier cutoff points are listed under the heading "HI" (highest value of LOS in the included group of patients for a DRG). The specialized hospitals excluded from the data base are listed in Appendix I.A.2. Even though the specialized hospitals are being excluded from the calculations of statewide norms, case-mix reports will still be provided to these hospitals. The new case-mix reports for all of 1976

will reflect the changes in outlier cutoff points and the separate treatment of specialized hospitals. As problems with data submission and processing are resolved, the case-mix reports may be produced regularly on a semiannual basis (probably October of a year for the first six months of the year, and April of the next year for the full twelve months of a year).

4. Reassessing the DRGs

The three hundred and eighty-three DRGs used in this Project were generated from large volumes of data submitted by New Jersey hospitals. Since these DRGs were formed, they have been used with other data sets and appear to be quite stable. That is, the same 383 DRGs appear to represent uniform groups of patients in other areas of the country and do not seem to be a simple artifact of New Jersey discharges.[8] However, advances in medical technology and changes in medical practice will have an effect on the treatment of certain cases. For example, a cure for some cancers would probably have a drastic effect on the resource utilization distributions for certain major diagnostic categories dealing with malignancies. This would change the DRG structure derived from the major diagnostic categories affected. Such changes must be monitored and the DRG structure modified to reflect them.

In assessing the continued appropriateness of the DRGs in use, it is not necessary to re-AUTOGRP every six or twleve months. One may compare current statistical behavior with past statistical behavior on a DRG by DRG basis. For example, under Task 6 project staff are planning to compare the statistical behavior of each DRG using data from the first six months of 1976 with the statistical behavior of each corresponding DRG using data from the first six months of 1977. This comparison will, in essence, examine the length of stay distribution for each DRG to detect any changes between 1976 and 1977. Certain changes would indicate that the DRG, as currently defined, no longer represents an optimal description of the data. For instance, if the lognormal distribution of LOS in 1976 turned into a bi-modal distribution in 1977, this would probably indicate that where one DRG optimally described the data in 1976, two DRGs would be needed to describe the data in 1977. A reason for this change might be that a new medical treatment was developed affecting some of the patients in the DRG and changing their LOS relative to the other patients. The detection of such changes, and subsequent modification of the DRG definitions, would keep the DRG structure maximally representative of contemporary medical treatment.

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8. This does not mean that patients in a DRG are treated the same in all areas, but that patients identified as belonging to the same DRG are treated in a similar fashion within each area.

Not all changes in LOS distributions indicate the necessity to re-AUTOGRP a major diagnosis category. An example of such a change would be an increase or decrease in the mean LOS for a DRG without a change in the shape of the LOS distribution. This modification might indicate a change in medial practice affecting all patients in a DRG. This type of change would affect the reimbursement level for the DRG, but would indicate that the definition of the DRG is still appropriate.

The reanalysis discussed above is planned for March or April, 1978. A reanalysis comparing data from all of 1976 with data from all of 1977 is planned for July or August, 1978. The frequency with which reanalyses will need to be conducted in the future is yet to be determined. Annual or semiannual reanalyses appear to be the most practical options.

A further reanalysis, tentatively planned for September or October 1978, is a complete re-AUTOGRPing of New Jersey's data using total allocated cost as the dependent variable rather than LOS. While LOS appears to be a satisfactory proxy for resource use, total cost is a more direct measure. This re-AUTOGRPing would partition the distribution of total costs for treating patients in a major diagnostic category as opposed to partitioning the distribution of LOS. All reanalyses discussed here are part of Task 6.

5. Medical Abstracts

The medical abstract is the raw material from which DRGs are formed. In order to use the DRG case-mix approach, there must be data available on all patients of interest (all patients discharged from New Jersey hospitals in this case). The data base used by the Department consists of a medical abstract produced from information contained in a patient's medical record for every patient discharged in New Jersey since January 1, 1976. This data is required by regulation and is submitted quarterly.

Abstract data come from seven sources: NJUP (New Jersey Utilization Program), PAS (Professional Activity Study of the Commission for Professional and Hospital Activities (CPHA)), and five hospitals with independent abstracting systems. The data on the medical abstract forms vary in detail and complexity. However, a minimum data set is required by regulation, and only the following portion of that information is required for casemix development:

- Hospital identification number
- Admission date --
- Discharge date -- for calculating length of stay
- Age of patient
- Primary diagnosis
- Secondary diagnosis (first listed)
- Primary surgical procedure
- Secondary surgical procedure (first listed)
- Discharge status (alive or dead)
- Patient identifier (for use only in obtaining error corrections from the hospital)
- Diagnosis/Procedure Coding Scheme--ICDA-8 or HICDA-2
- Primary Clinical Service (to identify psychiatric patients whose LOS would be greater than expected based only on the medical information provided)

There is a considerable amount of other data required by other parts of this Project and these needs are discussed in the appropriate sections of this report. Puter's Annual Report (Appendix II.A of this report) discusses in detail the contents of the medical abstract data bases and problems encountered in processing them. See especially the discussions under Tasks 2 and 3 and the corresponding appendices.

The problems with collecting and processing the various medical abstracts are being addressed. The current aim is to have all abstract data within 60 days of the end of a quarter for processing on schedule.

a. Other Users of Medical Abstract Data

The Department of Health is not the only user of medical abstract information. The State's Professional Standards Review Organizations (PSROs) also use this data set. Meetings of the PSRO-Department of Health Liaison Committee have been held since the second quarter of this Project. The most recent meeting was held October 25 to discuss specific issues with regard to data sharing. Both groups expressed consensus to data sharing because duplication would be avoided and cost savings would be realized for the PSROs and the public. However, two factors deserve attention: (1) The Department obtains data on all patients in the state while the PSROs only have jurisdiction over federally assisted patients, and (2) the PSROs receive confidential information (physician identifier codes) not needed or received by the Department. Meetings to resolve these and other issues are being held on a continuous basis.

Another user of medical abstract data are the Health Systems Agencies (HSAs). They have responsibility for health planning activities in their regions and need a considerable amount of data. A database system, called DATA[9] is being developed through the Department's Health Data Unit to provide data on an on-line system available to the HSAs via terminal. These data bases will also be accessible by any interested PSROs.

Other users within the Department include Health Plan Development Services and Certificate of Need. The activities of both of these groups and Health Economics Services overlap and are discussed in the Planning section of this report. (Refer to Charts 2, 3, and 4 for a more detailed description of Tasks identifying Case-Mix by DRGs.)

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9. DATA (Direct Access and Transfer of Data Accounts): A Health Planning Information System for the New Jersey Department of Health, New Jersey State Department of Health, Health Data Research and Analysis Services (Trenton, 1977).

CHART 2:
Diagnosis Related Groups (DRGs)

TASK #5: Machine Assignment of DRGs
TASK #6: Analyze and Modify DRGs
TASK #7: Modify Software

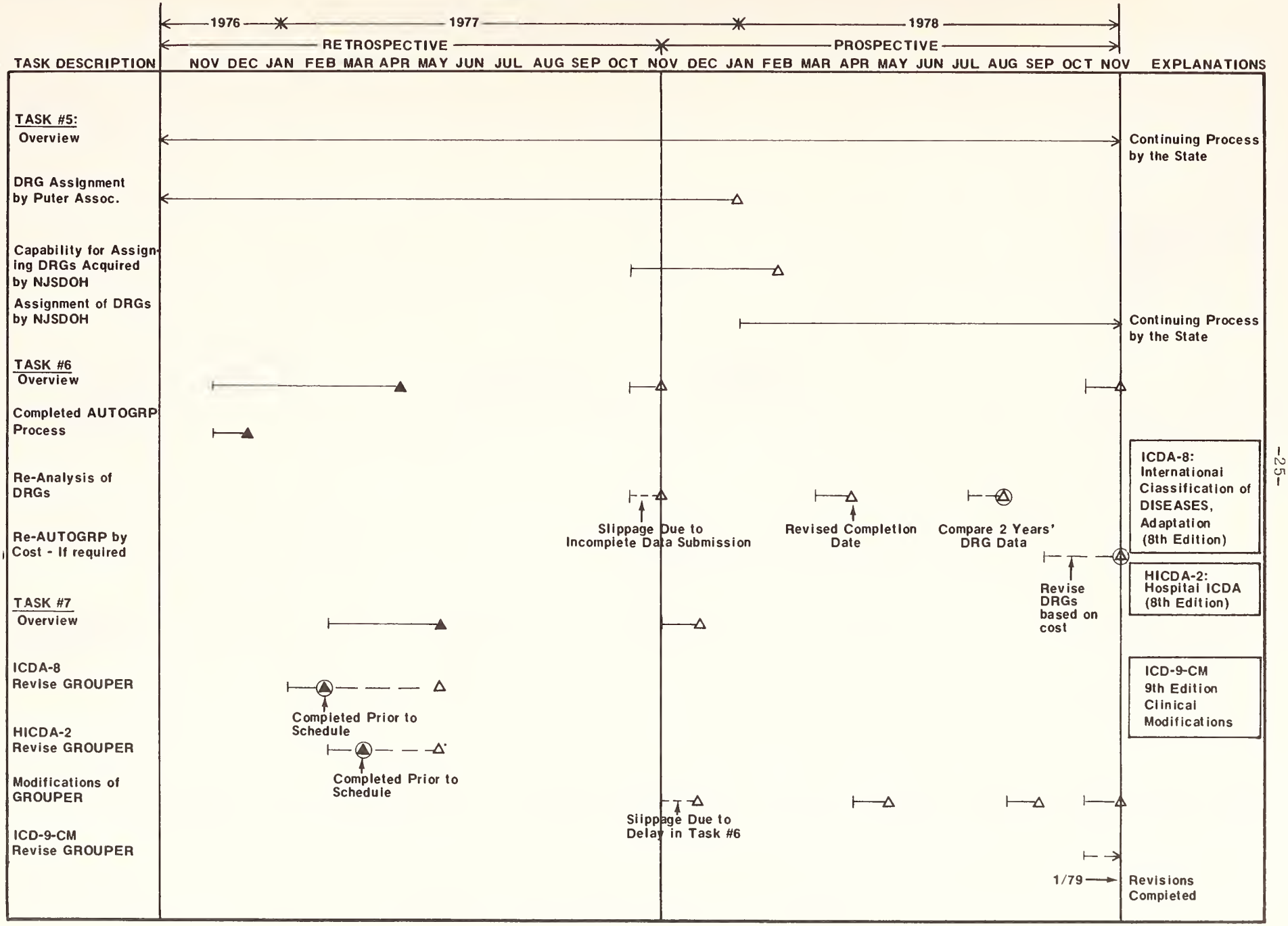


CHART 3:
Case-Mix Reports

TASK #8: DRG Patient Profile by Hospital and Statewide
TASK #9: Average LOS by DRG by Hospital and Statewide

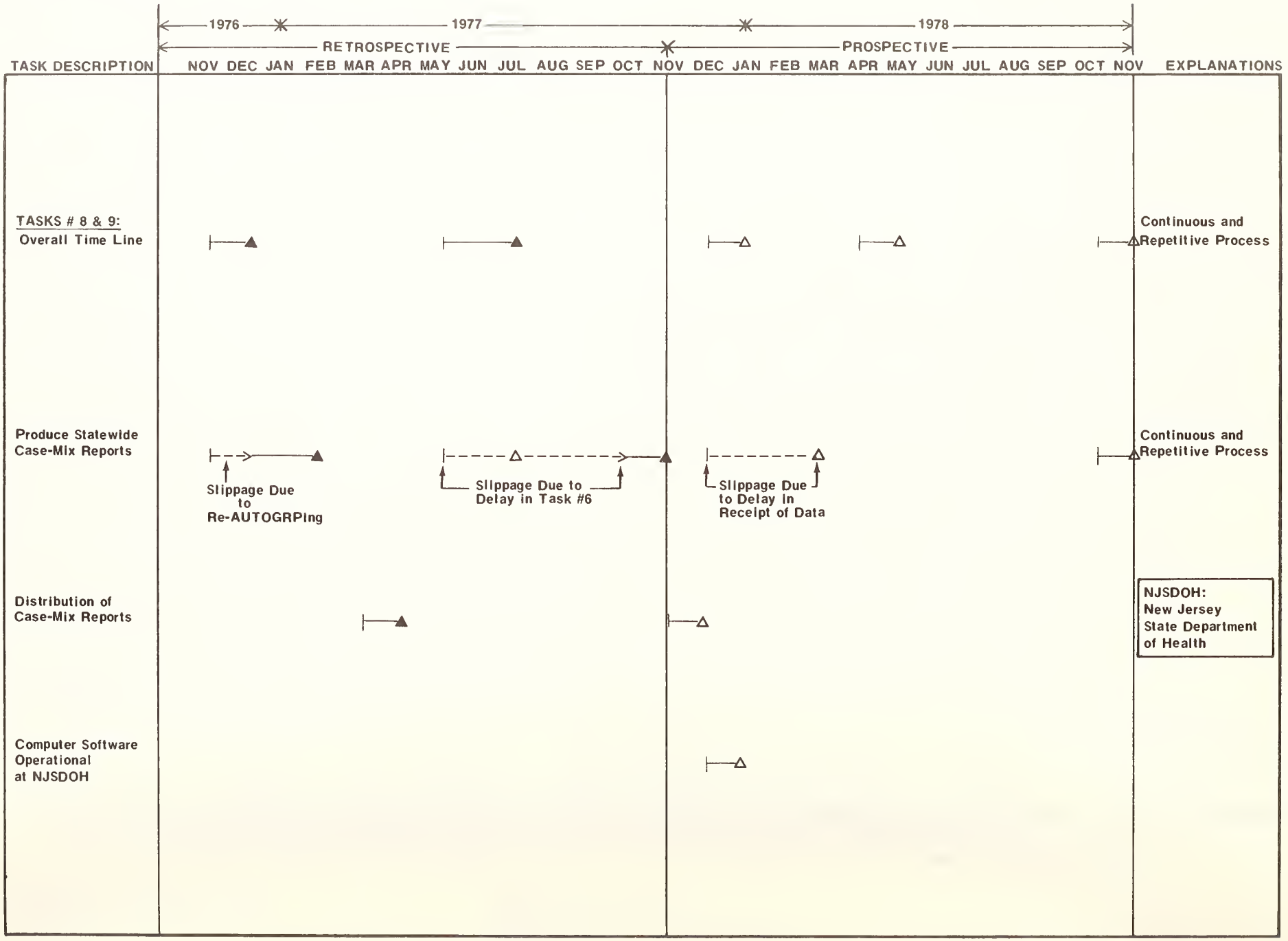
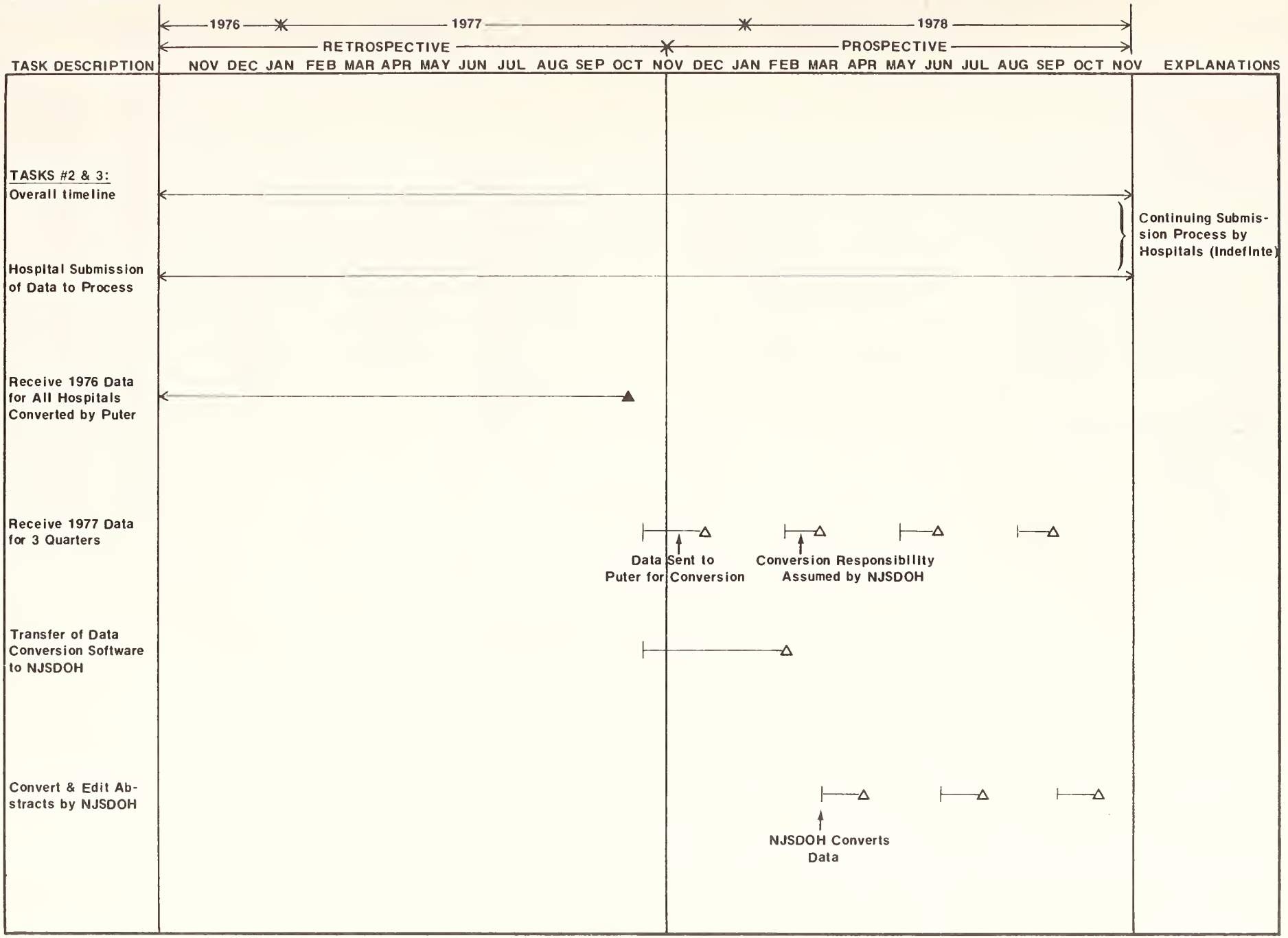


CHART 4:

Medical Abstracts

TASK #2: Hospital Medical Abstracts.
TASK #3: NJUP and PAS Tapes to Common Format.


1976
1977
1978
RETROSPECTIVE
PROSPECTIVE
TASK DESCRIPTION
NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV
EXPLANATIONS
TASKS #2 & 3:
Overall timeline
Continuing Submission Process by Hospitals (Indefinte)
Hospital Submission of Data to Process
Receive 1976 Data for All Hospitals Converted by Puter
Receive 1977 Data for 3 Quarters
Data Sent to Puter for Conversion
Conversion Responsibility Assumed by NJSDOH
Transfer of Data Conversion Software to NJSDOH
Convert & Edit Abstracts by NJSDOH
NJSDOH Converts Data

Section II

B. Costs per Diagnosis Related Groups (DRGs)

1. Ancillary Services
2. Nursing Services
3. Patient Care General Services
4. Institutional Cost
5. Application of the Case-Mix Model
6. Preliminary Results

FIGURE 7: Hospital Care Costs

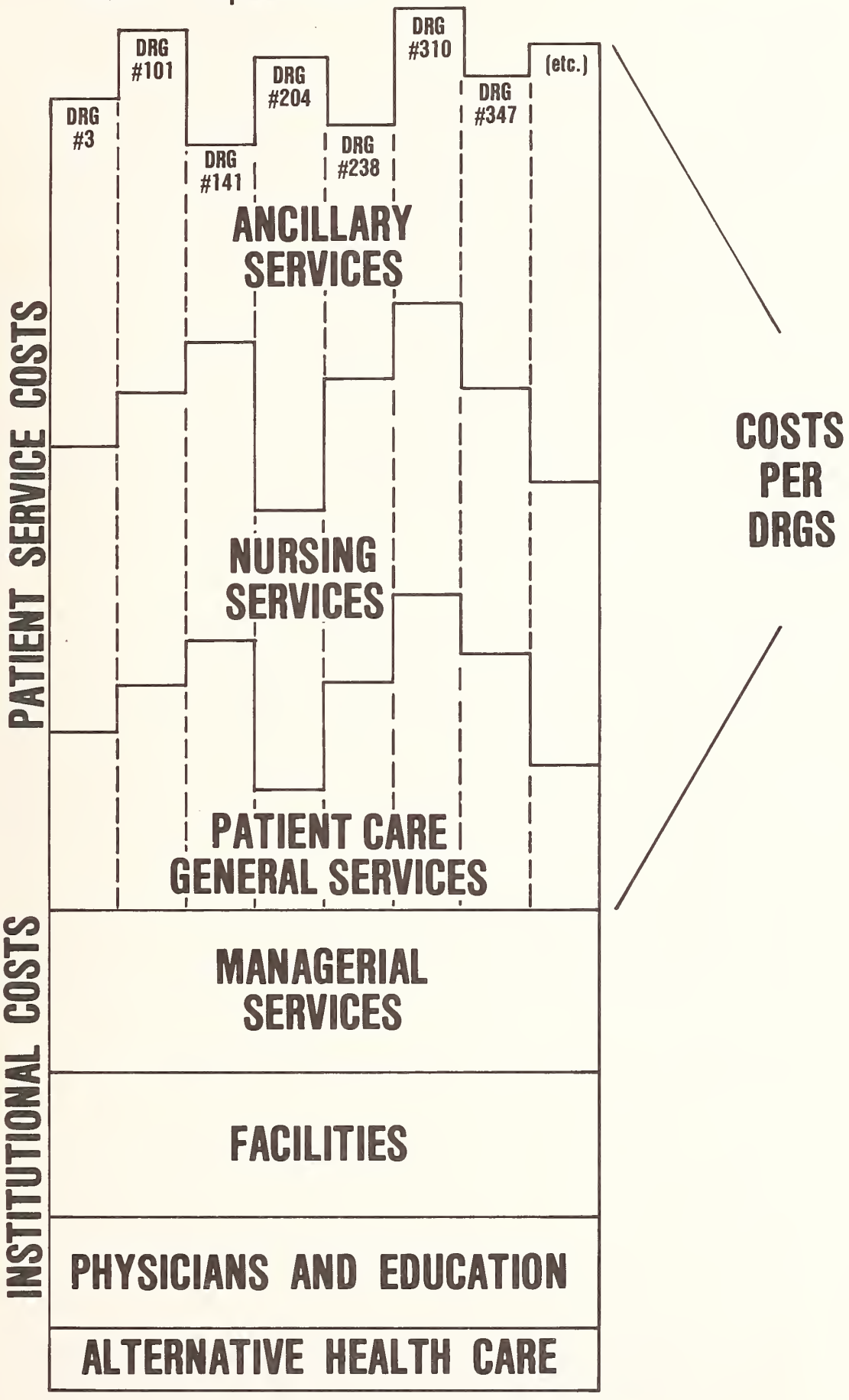
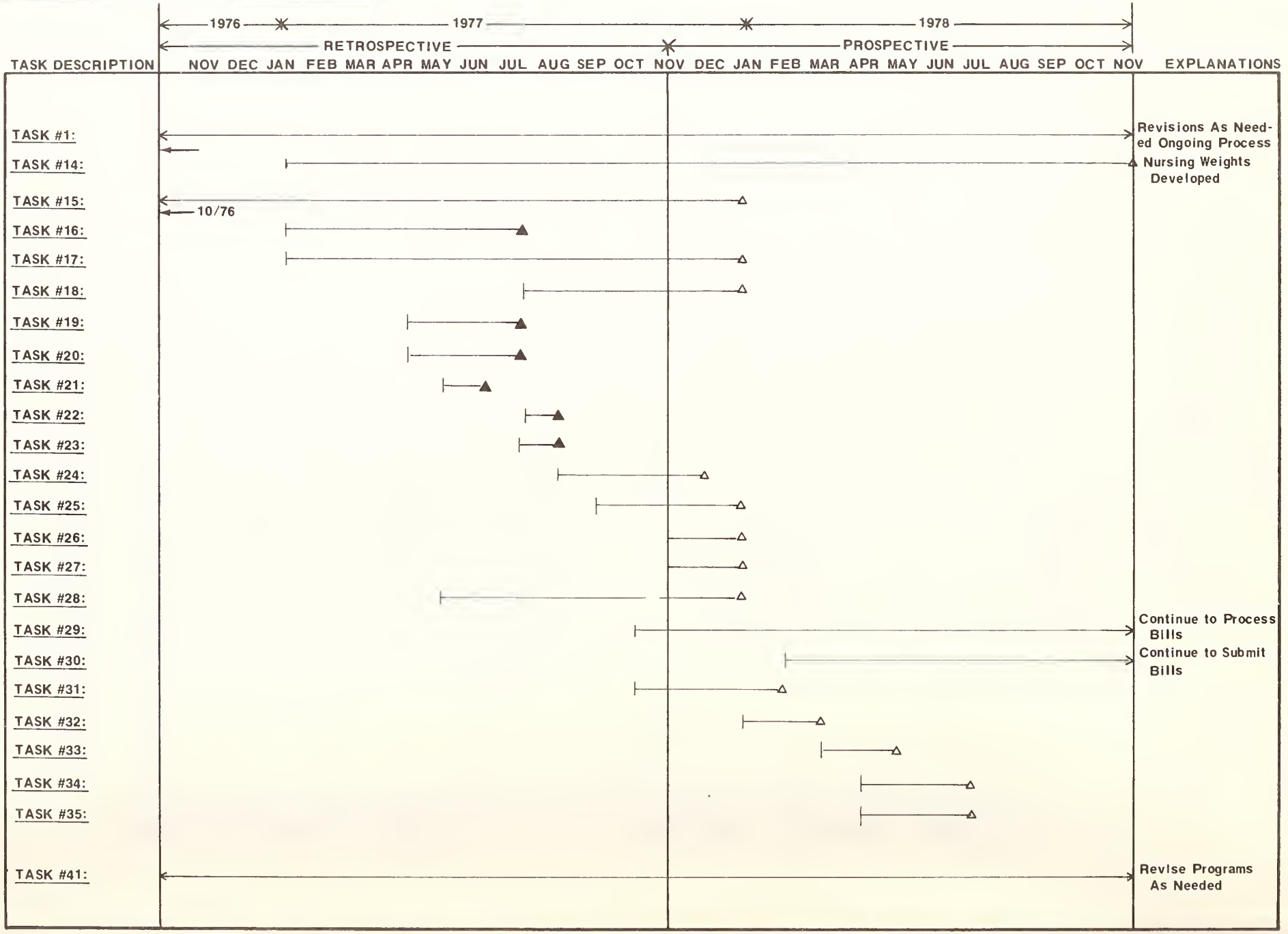


CHART 5:

Introduction: Hospital Care Cost Determination



B. Costed Diagnosis Related Groups (DRGs)

At a special meeting held on September 20, 1977, (to consider progress in developing the DRGs into a tool for reimbursement) the Project staff made a formal presentation to the Health Care Administration Board (HCAB), the body which must approve regulations promulgated under the relevant enabling statutes. Among the topics discussed at that meeting was the value of grouping costs by DRG rather than by cost centers such as laboratory or radiology. In short, what new kinds of information did the DRG point of view provide? The demonstration to the HCAB was developed by applying 1976 actual cost data from 4 of the 21 Experiment Hospitals to the DRGs. The numbers set forth below represent patient care service costs (i.e., ancillary services, nursing, and patient care general services) as opposed to institutional costs such as administration, which are treated separately. (See Section II.B.4, "Institutional Costs".) Refer to Figure 7 for the categories, and Chart 5 for the Tasks which make-up Hospital Care Costs.

Certain assumptions were made in generating the demonstration data: interim statistics were utilized for the allocation of nursing and patient care general service costs, and the consistency of physician cost reporting between these institutions had not yet been reviewed. The four hospitals were selected based on the availability of clean data: Hospitals A and D are suburban with A considered a large, non-teaching acute care institution, and D is a major teaching hospital. Hospital B is a minor teaching hospital located in a rural area, and Hospital C is a large acute care hospital located in an urban area.

The results of the trial run tended to demonstrate the appropriateness of the formation of the DRGs, especially with respect to the use of specific predictor variables. For example, Diagnostic Category No. 55, urinary calculus, is broken down into four DRGs:

1. DRG 239-urinary calculus without surgery, without secondary diagnosis

2. DRG 240-urinary calculus without surgery, with secondary diagnosis

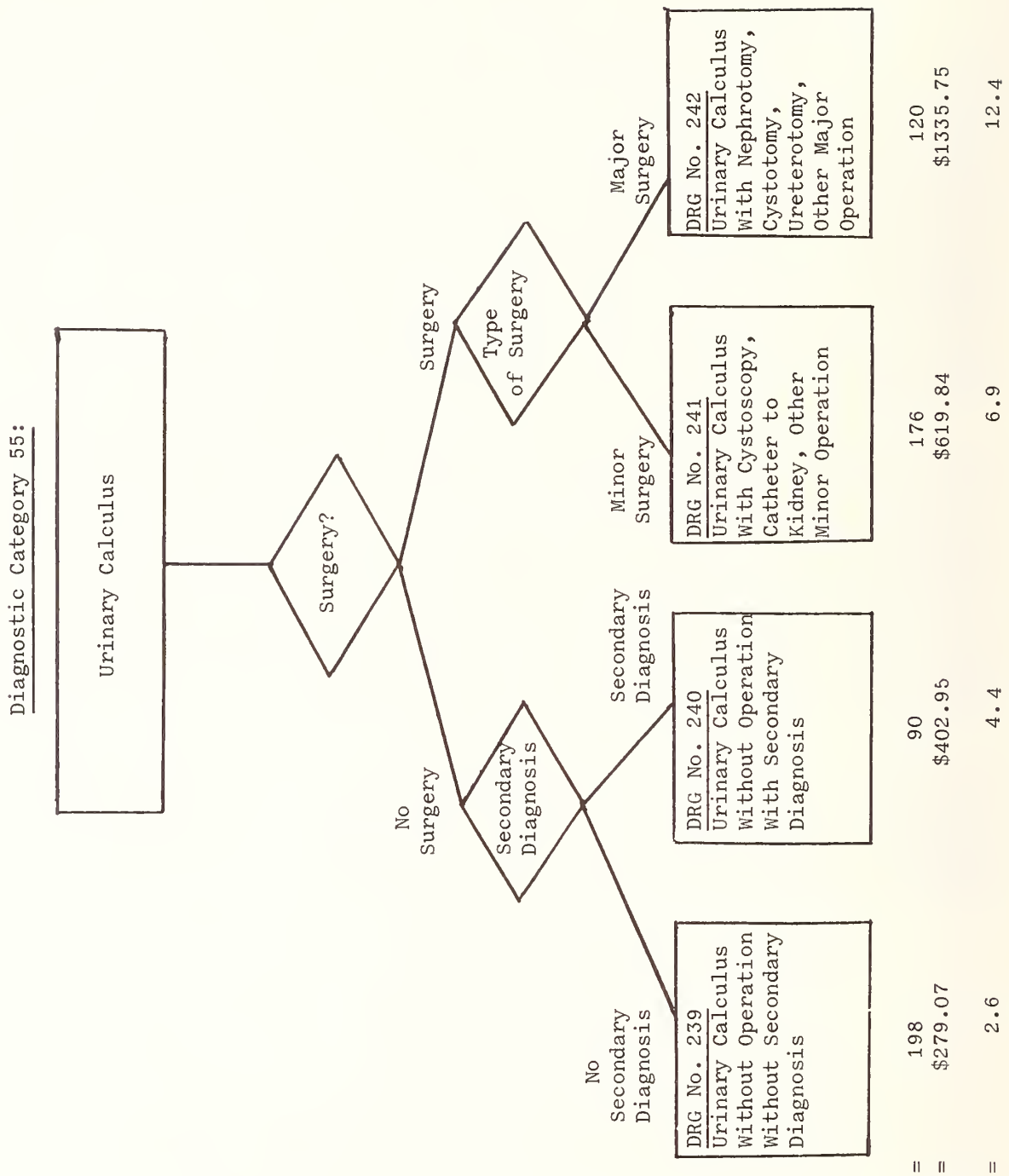
3. DRG 241-urinary calculus with minor surgery

4. DRG 242-urinary calculus with major surgery

Figure 8 (p. 32) presents a branching diagram for the urinary calculus DRGs with allocated costs of each DRG. The reader will note that the average patient with urinary calculus with neither surgery nor secondary diagnosis incurred costs of only $279.

FIGURE 8:

Branching Diagram of Urinary Calculus



With the presence of a secondary diagnosis, the cost increased by slightly over a third. The presence of minor surgery added an additional $200 and major surgery more than doubled that figure. DRG 242 cost $1,335 to treat, 4.8 times more that DRG 239.

Figures 9, 10, 11 and 12 present historgrams of the costs per case across the four trial run hosptials for the four urinary calculus DRGs.

In all four DRGs, the coefficients of variation (standard deviation/mean) were under a third -- .31 to .21. While encouraging for reimbursement purposes, it is the shapes of the histograms, particularly DRG 242, which open up an exciting avenue for further inquiry: are we looking at a grouping in need of additional refinement or some artifact of the health care delivery system (e.g., diversity in medical practice or latent efficiencies in certain institutions)? It is the focus of further inquiry which is likely to be important to the planner and the medical profession, as well as hospitals and regulators, in finding ways to clarify problems and thereby serve the public interest. DRGs are, of course, only common denominators; it is the different ways in which the data can be organized and examined which should prove exciting in the days to come.

Further results of the trial run (i.e., the distribution of patient costs for the eight most populous DRGs, the distribution of costs by hospital for the same DRGs, and a comparison of costs per diem and per case to show significant differences among selected DRGs) are presented in the final part of this section. The following portion of this section presents the basis upon which DRG costs are derived.

a. Classification of Hospital Costs: Sources of Data

The logical starting point in viewing hospital costs by patient case-mix is to receive uniform functional cost reports from hospitals. The functional hospital reporting system from which most of the cost data utilized in this Project is obtained is SHARE, the Standard Hospital Accounting and Rate Evaluation system, established for hospitals by the New Jersey State Departments of Health and Insurance. SHARE collects actual costs for the previous year, projected costs for the current year, and budgets for the following year by a uniform set of functional cost centers for all New Jersey Hospitals. These cost centers are grouped into the following three clusters of costs: patient care services (i.e., nursing), ancillary services, and general services.

FIGURE 9:

Histogram of DRG 239

DRG No. 239

Distribution of Costs Across Patients for All Trial Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
198	$55256	$279.07	$75.91

URINARY CALCULUS WITHOUT OPERATION WITHOUT SECONDARY DIAGNOSIS

VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
0- 49	0	.0%	.0%	
50- 99	0	.0%	.0%	
100- 149	3	1.5%	1.5%	***
150- 199	33	16.7%	18.2%	**********
200- 249	33	16.7%	34.8%	**********
250- 299	45	22.7%	57.6%	**********
300- 349	59	29.8%	87.4%	**********
350- 399	17	8.6%	96.0%	**********
400- 449	2	1.0%	97.0%	**
450- 499	4	2.0%	99.0%	****
500- 549	1	.5%	99.5%	*
550- 599	1	.5%	100.0%	*

FIGURE 10:

Histogram of DRG 240

DRG No. 240

Distribution of Costs Across Patients for All Trial Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
90	$36266	$402.95	$128.81

URINARY CALCULUS WITHOUT OPERATION WITH SECONDARY DIAGNOSIS

VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
200- 249	5	5.6%	5.6%	**********
250- 299	12	13.3%	18.9%	**********
300- 349	15	16.7%	35.6%	**********
350- 399	24	26.7%	62.2%	**********
400- 449	9	10.0%	72.2%	**********
450- 499	8	8.9%	81.1%	**********
500- 549	9	10.0%	91.1%	**********
550- 599	3	3.3%	94.4%	******
600- 649	1	1.1%	95.6%	**
650- 699	1	1.1%	96.7%	**
700- 749	0	.0%	96.7%	
750- 799	1	1.1%	97.8%	**
800- 849	0	.0%	97.8%	
850- 899	0	.0%	97.8%	
900- 949	2	2.2%	100.0%	****

FIGURE 11:
Histogram of DRG 241

DRG No. 241

Distribution of Costs Across Patients for All Trial Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
176	$109091	$619.84	$178.99

URINARY CALCULUS WITH CYSTOSCOPY, CATHETER TO KIDNEY,
OR OTHER MINOR OPERATION

VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
350- 399	3	1.7%	1.7%	***
400- 449	15	8.5%	10.2%	**********
450- 499	22	12.5%	22.7%	**********
500- 549	29	16.5%	39.2%	**********
550- 599	35	19.9%	59.1%	**********
600- 649	16	9.1%	68.2%	**********
650- 699	14	8.0%	76.1%	**********
700- 749	17	9.7%	85.8%	**********
750- 799	4	2.3%	88.1%	****
800- 849	3	1.7%	89.8%	***
850- 899	6	3.4%	93.2%	******
900- 949	3	1.7%	94.9%	***
950- 999	1	.6%	95.5%	*
1000- 1049	3	1.7%	97.2%	***
1050- 1099	0	.0%	97.2%	
1100- 1149	0	.0%	97.2%	
1150- 1199	2	1.1%	98.3%	**
1200- 1249	0	.0%	98.3%	
1250- 1299	1	.6%	98.9%	**
1300- 1349	0	.0%	98.9%	
1350- 1399	1	.6%	99.4%	*
1400- 1449	1	.6%	100.0%	*

FIGURE 12:
Histogram of DRG 242

DRG No. 242

Distribution of Costs Across Patients for All Trial Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
120	$160290	$1335.75	$293.80

URINARY CALCULUS WITH NEPHROTOMY, CYSTOTOMY, URETEROTOMY, OR OTHER MAJOR OPERATION

VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
850- 899	1	.8%	.8%	*
900- 949	2	1.7%	2.5%	***
950- 999	6	5.0%	7.5%	**********
1000- 1049	3	2.5%	10.0%	*****
1050- 1099	13	10.8%	20.8%	**********
1100- 1149	9	7.5%	28.3%	**********
1150- 1199	12	10.0%	38.3%	**********
1200- 1249	13	10.8%	49.2%	**********
1250- 1299	9	7.5%	56.7%	**********
1300- 1349	7	5.8%	62.5%	**********
1350- 1399	9	7.5%	70.0%	**********
1400- 1449	2	1.7%	71.7%	***
1450- 1499	6	5.0%	76.7%	**********
1500- 1549	4	3.3%	80.0%	******
1550- 1599	3	2.5%	82.5%	*****
1600- 1649	2	1.7%	84.2%	***
1650- 1699	1	.8%	85.0%	*
1700- 1749	5	4.2%	89.2%	********
1750- 1799	1	.8%	90.0%	*
1800- 1849	4	3.3%	93.3%	******
1850- 1899	4	3.3%	96.7%	******

The present methodology for the determination of Blue Cross and Medicaid reasonable cost reimbursement rates screens hospitals' costs by comparing costs in a cluster with the same functional costs of similar hospitals within a peer grouping (e.g., large acute hospitals) per a unit of service (patient days for the patient care and general service clusters and admissions for ancillary services). Depending on a hospital's performance with regard to these cluster screens, costs may then be compared with its peers at the cost center level. At present, the Department of Health does not audit data submitted on SHARE.

In order to investigate the accuracy of SHARE data and to obtain supplemental information for the development of DRG costs, site visits were made to all 21 sample hospitals participating in New Jersey Experiment II, the setting of prospective reimbursement rates based on patient case-mix for 1978. Each participating hospital voluntarily supplied a listing of their expense and revenue centers and a mapping of these centers to SHARE functional centers. Considerable variance from uniform functional reporting was uncovered in patient care service costs, partly due to ambiguities in SHARE definitions, and remedial reporting actions taken, as discussed in Sections I.B.1,2,3 below, and Chart 6. (See Third Quarter Report, Appendix A.1.B, "Nonuniformity of Hospital Cost Reporting to the New Jersey Department of Health.")

Similarly, the submission of billing data (See Section B-1, "Ancillary Services") has involved considerable efforts in insuring that hospital revenue centers are grouped consistently into functional reporting centers.

The classification of hospital costs employed by the Project represents a refinement of SHARE's taxonomy of ancillary services, partient care services, and general services. "Hospital care costs" are segregated from the other services provided by hospitals in New Jersey. That is, physician and educational costs and the delivery of alternative health care to inpatient services (e.g., emergency services, home health services, and Skilled Nursing Facilities) are not considered within the present scope of the Project. Therefore, this definition of hospital care costs encompasses 87.4 per cent of the hospital's total operating budget for 1977.

Hospital care costs are divided into patient care costs related to case-mix and non-case-mix related institutional costs. Figure 7 illustrates the decomposition of hospital care costs into the above categories. Patient service costs are trichotomized into ancillary services, nursing services, and patient care general services, each of which employs a separate methodology for relating costs to case-mix. These

resources are represented as vertical bars in Figure 7, and symbolize the consumption of resources by various classes of patients (i.e., DRGs). Managerial services and facilities costs, the components of institutional costs, are represented by horizontal bars symbolizing the identification of costs characteristic of the setting within which patient care services are provided. Parts B through E of this section provide a review of the Project's developmental activities with regard to ancillary services, nursing services, patient care general services, and institutional costs respectively. The final part of this section, the Case-Mix Accounting Model, illustrates how the building blocks of functionally grouped costs are apportioned to DRGs based upon a statistical Measure of Resource Use. The patient care service cost centers to be DRG related and their respective Measures of Resource Use are shown in Table 2.

CHART 6:
Introduction: Classification of Hospital Costs

TASK #1: SHARE Reporting (Modify as Necessary)

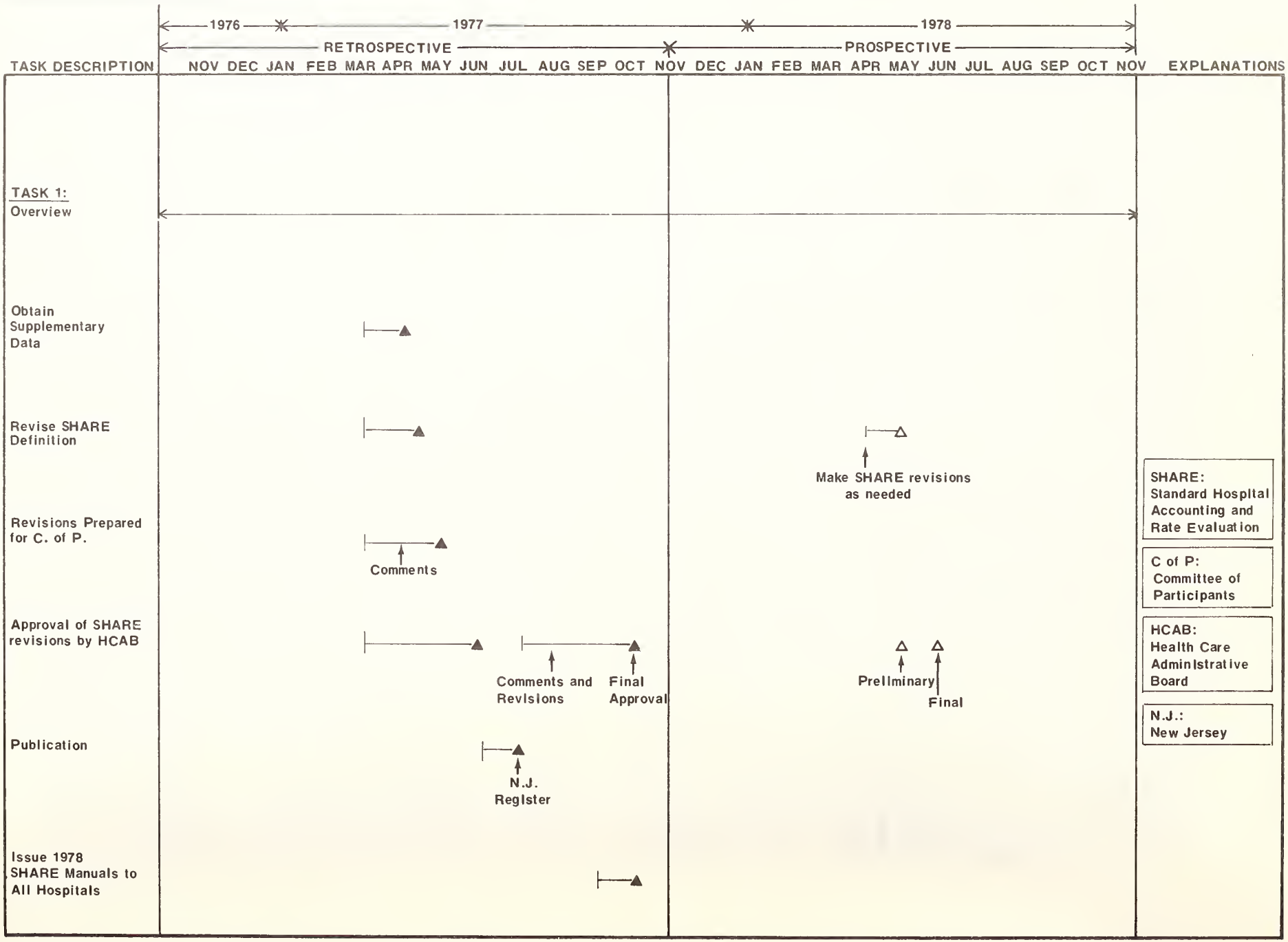
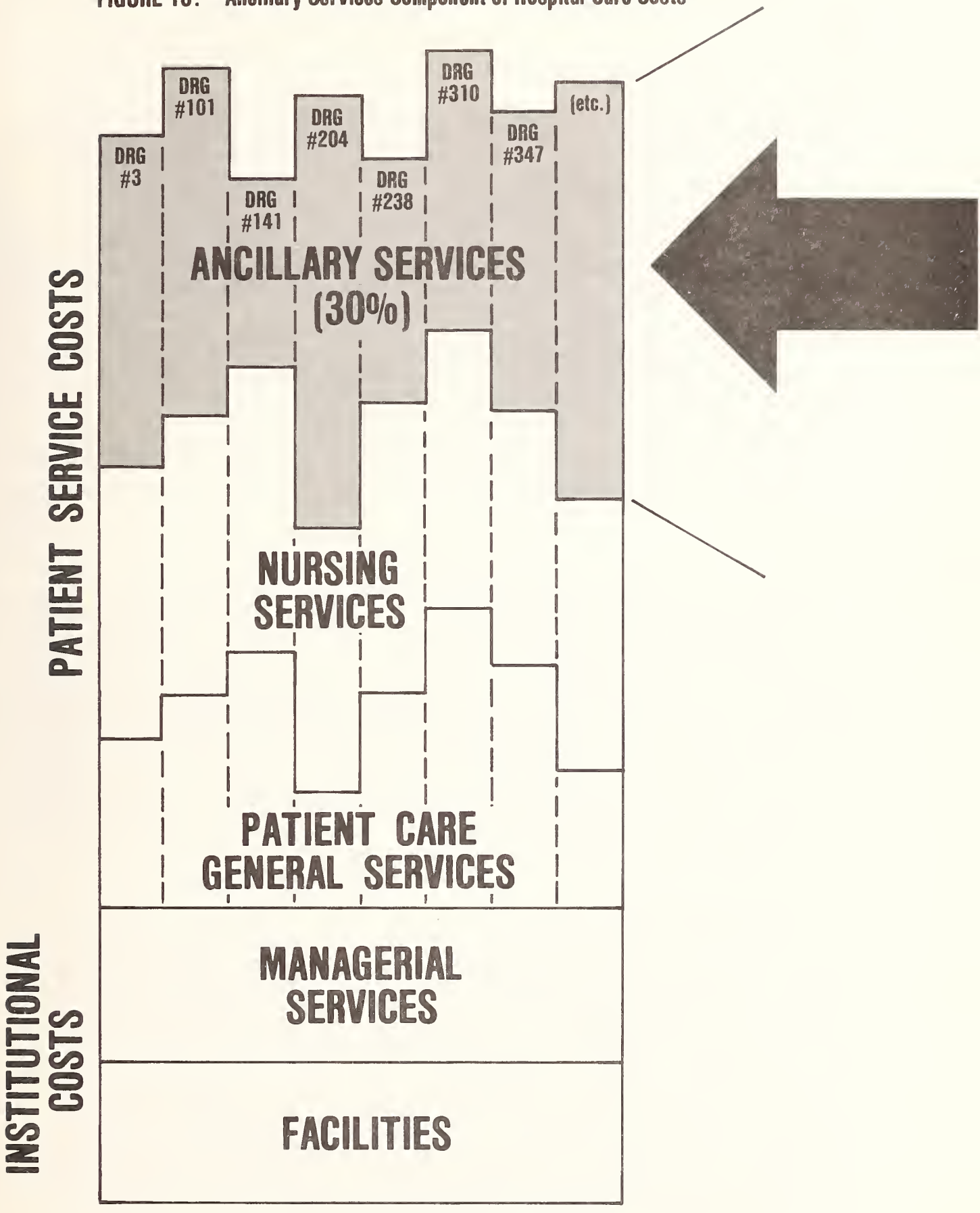


FIGURE 13: Ancillary Services Component of Hospital Care Costs



1. Ancillary Services

Ancillary services (Figure 13) are those patient care services which are charged for in addition to hospital room and board charges. Of the three major sectors of hospital management (i.e., nursing - usually under an R.N. Director, general services - reporting to administration directly, and ancillary services), physician management/control of ancillary services is greatest. These ancillary services, which are the diagnostic and therapeutic components of hospital medical care, have traditionally produced their own revenue due to the need to reimburse hospital based physicians on other than a salaried basis. Pathologists, radiologists, and similar specialists often receive compensation on a fee-for-service basis handled by the hospital's billing system or by a percentage of hospital revenue generated by their respective departments. Due to advancements in medical technology, these services, which are organized along the lines of medical specialties and sub-specialties, are perhaps the key component of hospital operating and capital cost increases in recent years.

a. Costs

Because of varying arrangements for the reimbursement of ancillary physician costs, reporting practices for ancillary service costs are far from uniform. Radiological and laboratory services, because of their inclusion under Part A (hospital reimbursement) of Medicare, are usually the most consistently reported of these costs. While SHARE mandates the reporting of the costs of physicians whose compensation is provided through or in agreement with a health care facility (i.e., salaries or fees received through the hospital billing system), many ancillary service physicians practice balance billing. This involves independently submitting a second bill to the patient, charging an amount greater than that allowed by the hospital's price structure. (Refer to Charts 7, 8, 9 and 10 for those Tasks identified with Ancillary Services.)

In services other than radiology and pathology such as anesthesiology, even the reporting of non-physician costs is not uniform. Often an anesthesiologist may directly hire nurse anesthetists, and the salaries of these people will not appear as a cost under SHARE when the anesthesiologist bills the patient independently. Ancillary service costs which will be allocated to DRGs will exclude costs for which reporting is not uniform; hence, physician salaries and fees except pathology (Laboratories and Blood Bank) and all anesthesiology expenses except supplies will be evaluated separately from the Case-Mix Accounting Model. The Project's effects to obtain uniform reporting of ancillary service physician costs were reported in the Second Quarter Report: Volume I, p. 60; and the Third Quarter Report: Volume I, p. 96.

Table 2:

Patient Care Service Cost Centers Included in Case-Mix Accounting Model

Cost Center	Measures of Resource Use
Nursing Services	
RNS:Registered Nursing Services	Relative Intensity Measures-RNs
LPN:Licensed Practical Nursing Services	Relative Intensity Measures-LPNs
ATT:Nursing Attendants	Relative Intensity Measures-Attendants
CLR:Unit Clerical Services	Relative Intensity Measures-Unit Clerks
Ancillary Services	
ANS:Anesthesiology	Charges
BBK:Blood Bank	Charges
CCA:Cardiac Catheterization	Charges
CSS:Central and Sterile Supply (Med-Surg Supplies)	Charges
DEL:Delivery and Labor Rooms	Charges
DIA:Dialysis	Charges
EDG:Electrodiagnosis	Charges
LAB:Laboratories	Charges
NMD:Nuclear Medicine	Charges
ORR:Operating and Recovery Rooms	Charges
OPM:Other Physical Medicine	Charges
PHM:Pharmacy	Charges
PHT:Physical Therapy	Charges
RAD:Diagnostic Radiology	Charges
RSP:Respiratory Therapy	Charges
THR:Therapeutic Radiology	Charges
Patient Care General Services	
DTY:Dietary Services	Diet-mix weights
HKP:Housekeeping*	Formula
L&L:Laundry and Linen*	Formula
MRD:Medical Records	Formula/weights

*Patient Care Service portion only

Project staff has also been concerned about certain internal hospital expense reporting practices under SHARE. Comparisons of internal hospital expense accounts with SHARE cost centers described in Section II.A.2, revealed considerable misunderstanding of SHARE ancillary services cost center definitions. As a result, in September 1977, new regulations abolished the "catch-all" Other Ancillary Services center while a center for Cardiac Catheterization was added; and definitions were improved for the remaining ancillary services in order to promote greater uniformity in functional reporting. (See Second Quarter Report: Volume I, p. 6-12; and Third Quarter Report: Volume I, p. 19-27.)

As reported in the Second Quarter Report: Volume I, Project staff found that medical and surgical supply costs required special methodological work before they could be related to DRGs. Under SHARE, such supplies may be initially reported in Central and Sterile Supply (CSS) or in the cost center in which the supplies are utilized. To overcome the varying reporting practices, the decision was made to combine supply costs for nursing centers and those ancillary services most likely to receive supplies from CSS into the CSS account. CSS costs will then be apportioned back to these cost centers and a center for Medical and Surgical Supplies Charged to Patients, based on the costed requisitions of such supplies. Where these supplies are apportioned to an ancillary service, their costs are spread to DRGs based on the Measure of Resource Use for that ancillary service. Supplies apportioned to patient care units are allocated to patients based on length of stay within each unit. Finally, supplies allocated to Medical and Surgical Supplies Charged to Patients are allocated to patients based on such charges.

b. Measures of Resource Use

In a multi-product firm in which any given expense center may devote its production of goods and services to all or any given subset of products, the exact identification of the cost of any given product is prohibited because of joint costs. Joint costs may be defined as those elements of an expense center which are not easily traceable to a particular product, yet are necessary for the production of goods and services from that expense center. An example may be drawn from argicultural production. Although one may accurately cost the feed consumed by a cow, the cow may produce meat and milk. The exact proportion of the costs of feed used for the production of milk as opposed to the production of meat may not be derived directly. One means of allocating the cost between meat and milk is to use a physicial allocation basis such as the ratio between the volume or weight of goods produced. However, this method is based upon the assumption that the ratio between the cost of feed consumed per unit of volume or weight is equiva-

lent in both meat and milk producing body systems. A preferred method for allocating such joint costs to products is to utilize the relative selling price of the two products times their respective volumes.[10]

A parallel may be drawn using an example from the production of hospital services. In order to relate operating room costs to the types of patients consuming operations, a "physical" basis such as Relative Value Units (RVUs) based on time per operation may be employed. Alternatively, charges per operation which may more accurately reflect the consumption of this service (for instance, taking into account the relative costs incurred between a major and minor surgical procedure) can be utilized. As a second example, the cost of preparing laboratory solutions which may be used for multiple tests consumed by patients with different conditions may be allocated to those patients based upon the price (or charge) of the test received.

The choice of appropriate Measures of Resoucre Use for ancillary services has been an area of considerable work during the Project's first year. While charges were proposed as part of the Project's initial design, the alternative of using various statistical measures (i.e., Relative Value Units-RVUs) was extensively examined. Despite Medicare regulations which require charges to be "related consistently to the cost of the service" (Ref. Medicare Provider Reimbursement Manual, Definition 2202.4, p. 22-7, Appendix I.B.2), representatives of the New Jersey Hospital Association have contended that charges bear little or no relationship to costs. A full discussion of this issue is contained in the Executive Summary of the Third Quarter Report.

For 14 of 16 ancillary services (drugs and supplies being the exceptions), alternate statistical units to charges were identified. (See Table 3, Alternate Statistical Units.)

For two ancillary services, Physical Therapy and Respiratory Therapy, the Project is working with the respective state professional associations to develop appropriate statistical units.

Because of the importance of the method chosen in allocating costs (i.e., charges or statistical units), these two alternatives were reviewed with the Hospital Financial Management Association's Task Force on Hospital Reimbursement on September 13, 1977. Although the group felt that statistical units might better reflect true costs, members present felt that the added expense of gathering and reporting this inforamtion outweighted the accuracy gained. Hence, the recommendation was made that the Project pursue the gathering of charge data and allow the reporting of statistical units as an option where such data is audited. (A full discussion of this choice appears in Appendix I.E in papers concerning current litigation.)

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10. Gordon Shillinglaw, Cost Accounting (Homewood, Illinois; 1967), 243-247.

TABLE 3:
Alternate Statistical Units

Ancillary Service	Possible Substitution of Statistical Units	Discussion
Anesthesiology (ANS)	Minutes of Anesthesia weighted by California Medical Association Relative Value Units (California RVUs)	More accurate measure, readily available from medical records Anesthesia Reports
Blood Bank (BBK)	Pints of blood (whole and packed cells)	More accurate measure, readily available from medical records
Cardiac Catheterization (CCA)	Number of catheterizations	available from current abstract data, but may not be as refined a measure as charges
Central and Sterile Supplies (CSS)	Charges	
Delivery and Labor Rooms (DEL)	Operative Procedure Code weighted By California RVUs or Delivery Room Time (ANS)	more accurate measure without additional data collection
Dialysis (DIA)	Number of treatments from Operative Procedure Code (Peritoneal and Hemo) weighted by California RVUs	Available from current abstract data

TABLE 3 (continued)

Ancillary Service	Possible Substitution of Statistical Units	Discussion
Electrodiagnosis (EDG)	Number of EKGs, EEGs, and EMGs, weighted by statewide average cost of each	readily available from medical records
Laboratories (LAB)	College of American Pathology Relative Value Units	more accurate measure of costs, ease of collection by patient is primary concern
Nuclear Medicine (NMD)	American College of Radiology (ACR) Radiology Relative Values for Nuclear Medicine	more accurate measure of costs, ease of collection by patient is primary concern
Operating and Recovery Rooms (ORR)	ORR Minutes (ANS) or California Medical Assoication RVUs applied to Operative Procedure Code	more accurate measure without additional data collection
Other Physicial Medicine (OPM)	Time (in half-hour intervals) of Occupational Therapy, Recreational Therapy, Speech and Hearing Therapy	likely availability because of charge structure
Pharmacy (PHM)	Charges	
Physical Therapy (PHT)	Relative Value Units currently being developed with NJ-APTA and NJHA	Not available currently

TABLE 3 (continued)

Ancillary Services	Possible Substitution of Statistical Units	Discussion
Radiology, Diagnostic (RAD)	American College of Radiology (ACR) Radiology Relative Values for Diagnostic Radiology and Diagnostic Ultrasonography	more accurate measures of costs, ease of collection by patient is primary concern
Respiratory Therapy (RSP)	Relative Value Units currently being developed with NJ-AART and NJHA	not currently available
Therapeutic Radiology (THR)	American College of Radiology (ACR) Radiology Relative Values for Radiotherapy	more accurate measure of costs, ease of collection by patient is primary concern

Since the Measure of Resource Use is used only to apportion costs to patients, the absolute value of the Measure is not important, so long as the same scale is used within any given hospital. Thus, whether charges based on statistical units (RVUs) or RVUs per se are used, is not relevant to the Case-Mix Accounting Model.

c. Gathering Billing Data from Sample of Hospitals

The obtaining of specific Measures of Resource Use (billing data) from each of the 21 hospitals has been a basic element of New Jersey Experiment II.

In August of 1976, contracts between the State of New Jersey and hospitals choosing to participate in the case-mix reimbursement experiment were drafted and mailed to the hospitals for endorsement. Twenty contracts were completed and returned between September and December of 1976 with one additional contract received in May of 1977. As provided by the contract, each hosptal agreed to furnish (in a computer processable input medium) the State Department of Health, through its designated subcontractor, with individual inpatient bills containing charges for both identified special services (e.g., ancillary) and routine services (e.g., room and board) for at least one quarter's discharges previous to July 1, 1976 and for three quarters thereafter. In addition, the hospitals were required to submit to the State for the same period a medical abstract for each discharge, containing a linking number to the bill, in accordance with NJAC 8:31 A-10.3(e). Specific file specifications (data processing instructions) were sent to the hospitals along with the contracts.

The State's obligations under the contract included: (1) providing the Experiment hospitals with reports showing costs associated with each Diagnosis Related Group (DRG), (2) calculating and approving a DRG budget for each hospital, and (3) allowing participation costs as a direct add-on to Blue Cross allowable costs.

The billing and medical abstract data required by the contract were received and analyzed throughout 1977 by Puter Associates, the subcontractor for the State. Of great importance is the fact that 19 of the 21 Experiment hospitals reported four complete quarters of data for 1976 while only two hospitals could provide less than a full year's data. (See Third Quarter Report: Volume I, p. 81.) A full calendar year's data are necessary if SHARE cost data, collected on a calendar year's basis, are to be used without substantial adjustment in the costing of ancillary services.

Numerous deviations from the file specifications contained in the contract were discovered. Most significant among these was the lack of a linking number on both a patient's medical abstract and bill. Such a linking number is needed if these two records are to be matched and a cost per DRG obtained via the methodology outlined in Section II.B.5. However this lack of a linking number in most instances was traced to the provision of an additional "check digit" by some billing processors not contained on the corresponding discharge abstract. Another problem found with the reported data involved the absence of a separate bill for each newborn for some hospitals due to Blue Cross reimbursement provisions. In some cases, newborn charges were either included on the mother's bill or (usually when the baby was detained) split between the mother's bill and the baby's bill (generated from the date of the mother's discharge).

Hospitals experiencing the above problems were contacted and corrections made wherever possible. Regarding the problem with newborn medical abstracts and bills, substantial time was spent contacting 11 of the 21 hospitals to obtain specific information on the data reporting errors being made, correcting the data already reported, and devising methods to improve future reporting.

Another data reporting error discovered in reviewing the billing data and internal hospital charge lists involved the incorrect grouping of ancillary charges on patient bills. According to the file specifications included with the contract, charges were to be summarized into revenue categories reflecting the expense centers within which they were generated (i.e., summarized into revenue reporting centers which correspond to SHARE ancillary cost centers).

Three sources of bill mismappings were identified: (1) lack of communications within hospitals between personnel responsible for submitting bills (data processing) and personnel responsible for preparing SHARE reports (budget personnel), (2) insufficiently detailed and incorrect file specifications, and (3) ambiguity of SHARE cost center definitions, especially Other Ancillary Services. To correct the improperly grouped charges, the Project reviewed in detail the charge lists of each of the 21 Experiment hospitals and sent to Puter Associates detailed descriptions of mismapped charges and the SHARE cost centers to which they should be remapped.

Because some of the hospitals who processed their own bills (independent) and all hospitals whose bills were processed by Shared Medical Systems (a billing processor) had retained copies of the billing data submitted, their billing data were reprocessed in the corrected format. Billing data submitted by Tymshare (another billing processor) for three of the Experiment hospitals were not preserved, and therefore, could not be reprocessed. To correct the effect the misreported Tymshare data would have had on the 1978 rates to be developed for the 21 Experiment hospitals, the SHARE costs reported by the three Tymshare hospitals were rearranged to correspond to the way in which these hospitals' charges were reported on the bills submitted. For example, if all Nuclear Medicine (NMD) charges had been incorrectly grouped under the SHARE ancillary cost center entitled Radiology (RAD), the hospitals' Nuclear Medicine costs as reported under SHARE were recast to the SHARE Radiology cost center. This step preserved the reasonably accurate cost to charge relationship necessary to determine relative costs of ancillary services consumed by patients in each DRG; the exact mix of ancillary services corresponding to SHARE cost centers by DRG is confounded for the three Tymshare hospitals.

d. Billing Data from All New Jersey Hospitals

In order to obtain billing information from all New Jersey hospitals, a regulation, Reports to Relate Ancillary Service Charges with Hospital Case-Mix, was promulgated. For a detailed explanation of the activities of June, July and August relating to this regulation, refer to the Third Quarter Report: Volume I, Tasks No. 21 and 22, pp. 103-110 and to Appendix I.E.

Virtually all of the Project staff's time between August 31 and September 20 (the Health Care Administration Board (HCAB) voting date) was spent reviewing, analyzing and responding to industry comments on the proposed regulation as it appeared in the August 4th New Jersey Register. The basic complaints voiced by the industry focused on what was felt to be the excessive cost and inconvenience the regulation would impose upon New Jersey hospitals prior to the completion of Experiment II. Specific responses were drafted for each comment sent to the Department. (Appendix I.B.3) Statistical and cost data were compiled to address complaints regarding excessive compliance costs. (Appendix I.B.3) In addition, data collection alternatives were drafted for those hospitals without access to an in-house or shared computer needed to process the data required by the regulation. (Appendix I.B.7) Finally, to address criticisms that the use of a cost to charge ratio applied to charges as a Measure of Resource Use to determine relative costs of ancillary services would be inaccurate, possible alternate statistical measures (e.g., Relative Value Units), were considered. (See Table 2.)

All of this information was presented as alternatives to representatives of the Hospital Financial Management Association Task Force on Hospital Reimbursement at John F. Kennedy Hospital on September 13. Significant comments were obtained and incorporated into the body of the proposed regulation. See Exhibit 1 for the regulation that appeared in the August 4 New Jersey Register and Exhibit 2 for the regulation approved by the HCAB on September 20.

Representatives from New Jersey hospitals and all other interested parties were invited to attend a September 15 meeting of the Committee of Participating Hospitals (i.e., the 21 Experiment hospitals) to address the data collection requirements of the proposed billing regulation. With the input from responses received as a result of publication of the proposed regulation in the Register, as well as the personal comments made at the two meetings outlined above, the Department revised the proposed billing regulation to ease any possible burdens it would impose on the hospitals. This was done by the inclusion of a provision which staggered compliance dates between December 1, 1977 to September 1, 1978, depending upon the current data processing capabilities of the hospital. In addition, the regulation specified that reasonable costs of compliance would be recognized in SHARE budget submissions and that those hospitals wishing to report RVUs rather than charges would be allowed to do so, subject to the Department's approval.

The billing regulation as revised above was passed by the HCAB on September 20. (See Appendix I.B.5 for minutes of this meeting.) Project staff immediately began efforts to aid New Jersey hospitals in compliance with the newly passed regulation. Work began in late September to develop a Charge Mapping Manual (See Appendix I.B.6.) which would be distributed to all New Jersey hospitals and would explain: (1) the purpose of the regulation, (2) which charges were to be reported to the Department, (3) how these charges were to be grouped (i.e., by ancillary, routine, and miscellaneous services as defined by SHARE and the Manual), (4) ways of avoiding errors in reporting, and (5) the data processing file specifications required. The specifications were established to conform with the data processing facilities of the Department of Transportation (DOT), the Department of Health's designated computer processor. The DOT IBM 370 system can read 9-track magnetic tape, punched cards, and disc-packs. Since the latter are impractical for transporting data, specifications were developed for magnetic tape and cards.

EXHIBIT 1:

Regulation for August 4 Register

HEALTH

THE COMMISSIONER

Proposed Rule Concerning Reports to Relate Ancillary Service Charges with Hospital Case-Mix

Dr. Joanne E. Finley, Commissioner of Health, pursuant to authority of N.J.S.A. 26:2H-1 et seq. and with the approval of the Health Care Administration Board, proposes to adopt a new rule concerning reports to relate ancillary service charges with hospital case-mix.

Full text of the proposed rule follows:

8:31-16.17 Reports to relate ancillary service charges with hospital case-mix

(a) Effective October 1, 1977, each hospital included under the provisions of N.J.S.A. 26:2H-1 et seq. shall submit to the Department of Health, for each patient discharged, a record of the total charges incurred by the patient in each ancillary service, as those ancillary services are defined by the Standard Hospital Accounting and Rate Evaluation (SHARE) Manual for costs, total routine charges, total miscellaneous charges and total charges.

(b) Subject to determination by the Department, hospitals shall submit such charges in a computer processable input medium and format on a quarterly basis within 60 days of the end of a quarter, with the first report being submitted by February 28, 1978.

(c) By September 15, 1977 each hospital shall submit to the Department a record of the individual charge items which are included within each ancillary service definition. A detailed list of any changes, additions or deletions in items or procedures charged for, or the ancillary service classification within which an item or procedure is reported, excluding price changes, shall be submitted previous to the quarter for which such changes will be made.

(d) Hospitals shall have the option of expanding their medical abstract reporting format to incorporate the required billing information. By September 15, 1977 each hospital electing this option shall so inform the Commissioner.

(e) Patient charge records must include a patient number, a hospital number and patient's date of discharge identical to that provided on the medical abstract data, in order to allow for computer linkage of the two data bases, as required by N.J.A.C. 8:31-20.2(h).

(f) At its September, 1977 meeting the Health Care Administration Board shall consider a report by the Commissioner on the progress to date of the Experiment on Case-Mix Reimbursement in developing a cost per case and the reasonableness of implementing case-mix reimbursement in mid-1979 for New Jersey hospitals. Following the report a vote shall be taken on the regulation set forth above and, upon an affirmative vote, said regulation shall become effective, as of October 1, 1977.

Interested persons may present statements or arguments in writing relevant to the proposed action on or before August 24, 1977, to:

John B. Reiss
Assistant Commissioner
Health Planning and Resources Development
Department of Health
John Fitch Plaza
Trenton, N.J. 08625

The Department of Health, upon its own motion or at the instance of any interested party, may thereafter adopt this rule substantially as proposed without further notice.

Dr. Joanne E. Finley
Commissioner
Department of Health

EXHIBIT 2:

Approved Regulation by HCAB

HEALTH

THE COMMISSIONER

Notice on Full Text of Rule Concerning Reports to Relate Ancillary Service Charges with Hospital Case-Mix

Take notice that, the Notice of Adoption concerning reports to relate ancillary service charges with hospital case-mix (See: 9 N.J.R. 467(c), R.1977 d.361) indicated that the rule adopted had substantive changes made in comparison to the proposed rule which was printed August 4, 1977, at 9 N.J.R. 363(a).

Full text of the adopted rule follows:

8:31-16.17 Reports to relate ancillary service charges with hospital case-mix

(a) By November 1, 1977, each hospital included under the provisions of N.J.S.A. 26:2H-1 et seq. shall submit to the Department of Health a list of the individual items and procedures charged for within an individual ancillary service for each ancillary service cost center as defined by the Standard Hospital Accounting and Rate Evaluation (SHARE) Manual. Thereafter, information which may affect this list for a given ancillary cost center, including newly-billed services and changes in billing practices, shall be furnished to the department in a timely manner prior to implementation. No information with respect to the price or price change concerning any item need be furnished.

(b) Each hospital shall submit to the Department of Health for each patient discharged a record of the total charges incurred by the patient within an individual ancillary service for each ancillary service cost center defined by SHARE. In addition, the hospital shall submit a summary of total routine charges, a summary of total miscellaneous charges and a summary of total charges for each patient. Such information shall be submitted pursuant to the timetable set forth in subsection (c) of this section.

(c) On November 1, 1977, the commissioner shall designate three classes of institutions:

1. Class I institutions shall consist of all hospitals which either possess or utilize electronically-assisted data processing systems for patient billing. Such institutions shall submit the required data beginning with patients discharged on December 1, 1977.

2. Class II institutions shall consist of all institutions otherwise considered Class I which, because of unique circumstances, will not be able to submit in an effective and efficient manner the required data beginning December 1, 1977. An application to be considered Class II shall be submitted by such institutions no later than October 20, 1977 and must set forth: i. A description of the unique circumstances; and ii. A detailed plan to achieve effective and efficient compliance beginning with patients discharged on March 1, 1978, but in no event later than June 1, 1978.

3. Class III institutions shall consist of all hospitals which neither possess nor utilize electronically-assisted data processing systems for patient billing. On or before October 20, 1977, all such institutions shall submit a report setting forth their current data processing status. On or before June 1, 1978 the department and each Class III hospital shall jointly develop a plan for effective and efficient compliance no later than September 1, 1978. Any Class III institution may apply to the commissioner for permission to begin submitting data as soon as they are able to provide such data efficiently and effectively. Such data may be submitted beginning with discharges on December 1, 1977.

4. The department may waive this requirement with respect to any institution unable to provide data in an effective and efficient manner.

5. Unless otherwise specified by the department, hospitals shall submit the data required above in a computer processable input medium and format on a quarterly basis within 60 days of the end of the quarter. Hence, Class I hospitals shall submit such data by February 28, 1978, for patients discharged on or before December 31, 1977; the next report due by May 30, 1978, for patients discharged on or before March 31, 1978, and so forth. Class II and III institutions shall submit the required data in a similar manner beginning 60 days after the quarter during which compliance is achieved.

(d) Patient charge records shall include a patient number, a hospital number and patient's date of discharge identical to that provided on that patient's medical abstract in order to facilitate computer linkage of the two data bases, as required by N.J.A.C. 8:31-20.2(b).

(e) Reporting and statistical options rules are:

1. Reporting options: Hospitals shall have the option of expanding their medical abstract reporting format to incorporate the required billing information. By November 20, 1977, each hospital electing this option shall so inform the department.

2. Statistical options: Hospitals shall have the option of reporting statistical units which measure relative resource consumption by ancillary service subject to department approval of a written application to exercise this option setting forth the choice of appropriate statistical units and adequate auditing safeguards.

(f) Each hospital shall identify in its SHARE budget submission, and the Department shall recognize, the reasonable costs incurred as a direct result of compliance with this regulation.

This Notice is published as a matter of public information.

G. Duncan Fletcher
Director of Administrative Procedure
Department of State

To insure that the Manual included all relevant information hospitals would need in an understandable manner, visitations were made to Puter Associates and St. Michael's Hospital for technical assistance. In addition, numerous Department of Health employees knowledgeable in hospital and medical terminology and practices were consulted for their input. The Manual was mailed to all New Jersey hospitals and billing processors on October 21. Four workshops were held during October and November at various locations throughout the state for hospital administrative, billing, data processing, and medical records personnel in order to discuss the contents of the Manual and to air any questions relating to compliance with the regulation.

CHART 7:

Ancillary Services

TASK #15: Billing Data from Sample Hospitals
TASK #16: Analyze Billing Practices of Sample of Hospitals
TASK #17: Billing Data of Sample Hospitals into Common Format
TASK #19: Determine 1977 Budget Equalized Ancillary Service Costs for Sample of Hospitals

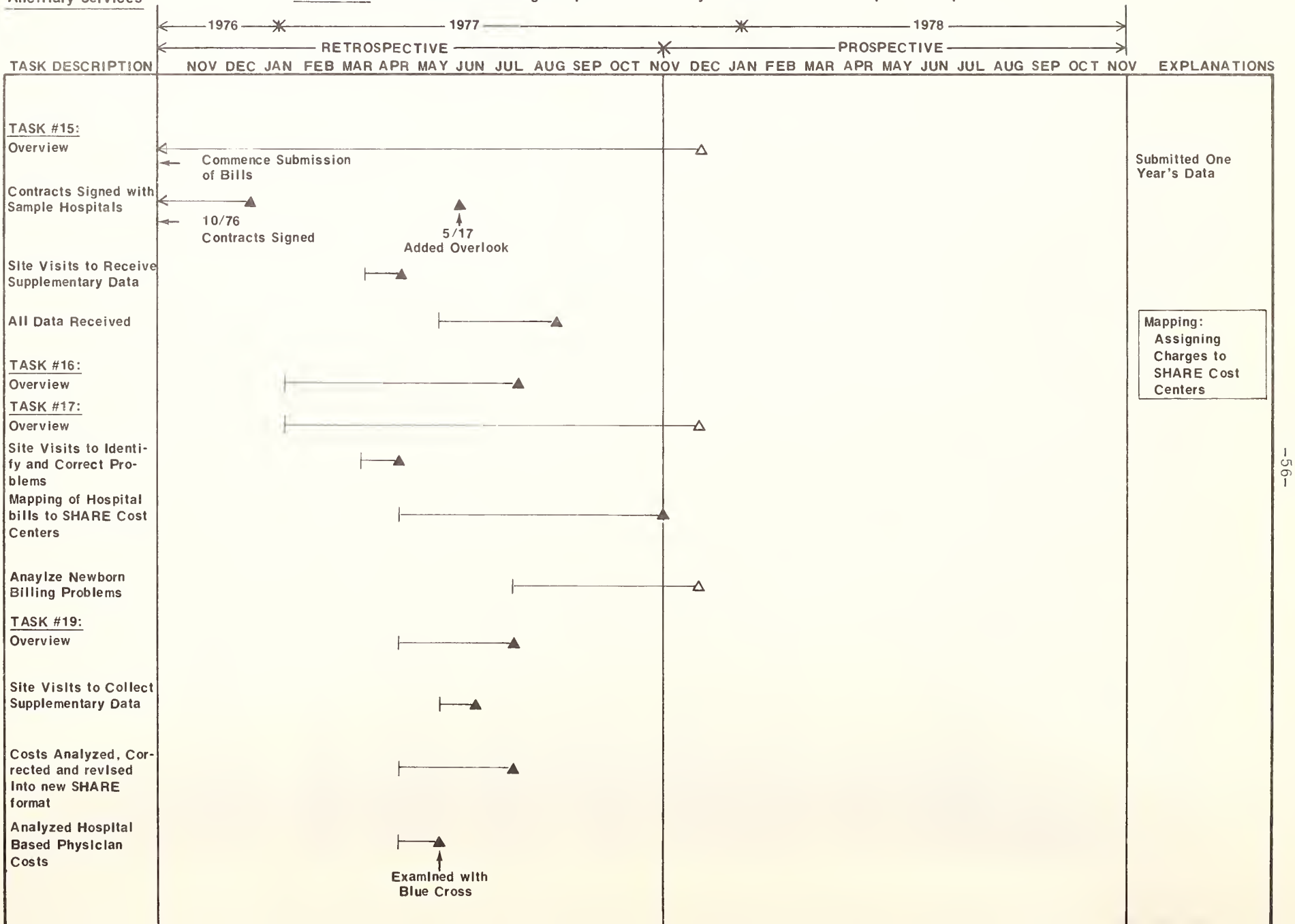

1976
1977
1978
RETROSPECTIVE
PROSPECTIVE
TASK DESCRIPTION
NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV
EXPLANATIONS
TASK #15:
Overview
Commence Submission of Bills
Submitted One Year's Data
Contracts Signed with Sample Hospitals
10/76 Contracts Signed
5/17 Added Overlook
Site Visits to Receive Supplementary Data
All Data Received
Mapping: Assigning Charges to SHARE Cost Centers
TASK #16:
Overview
TASK #17:
Overview
Site Visits to Identify and Correct Problems
Mapping of Hospital bills to SHARE Cost Centers
Anaylze Newborn Billing Problems
TASK #19:
Overview
Site Visits to Collect Supplementary Data
Costs Analyzed, Corrected and revised into new SHARE format
Analyzed Hospital Based Physician Costs
Examined with Blue Cross

CHART 8:

Ancillary Services

TASK #20: Establish RCC for Ancillary Cost Centers for Sample of Hospitals
TASK #21: Introduce Regulation for Submission of Billing Data in Common Format for All Hospitals
TASK #22: Promulgate final Regulation

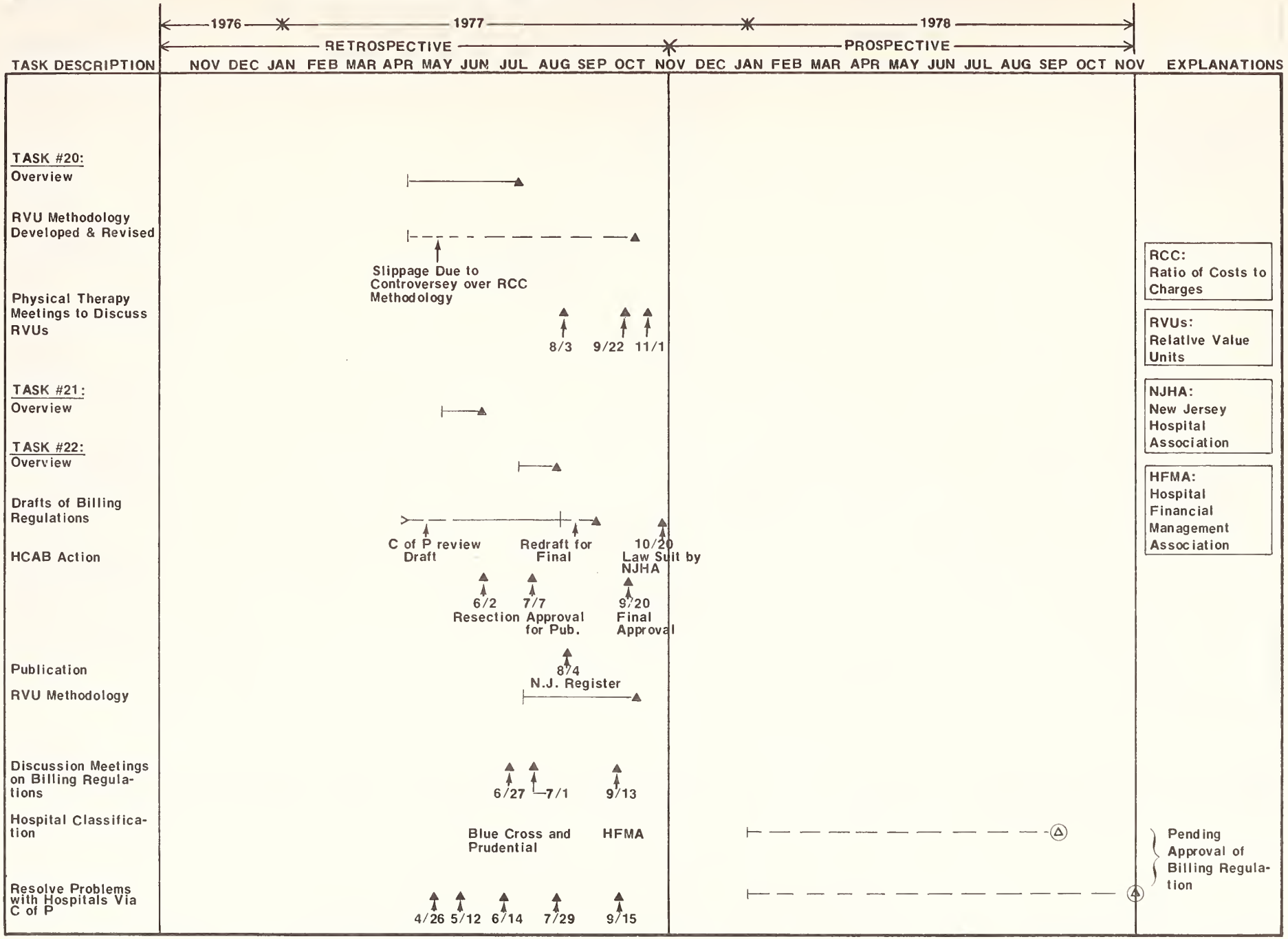


CHART 9:

Ancillary Services

TASK #23: Allocate Equalized Costs to DRG for Sample of Hospitals
TASK #24: Review and Analysis of Costs per DRG for Sample of Hospitals
TASK #28: Train Analysts and Hospitals in use of Common Billing Reporting format
TASK #29: Submission of Bills in a Common format from all Hospitals Quarterly
TASK #30: Process Billing Data for All Hospitals Quarterly

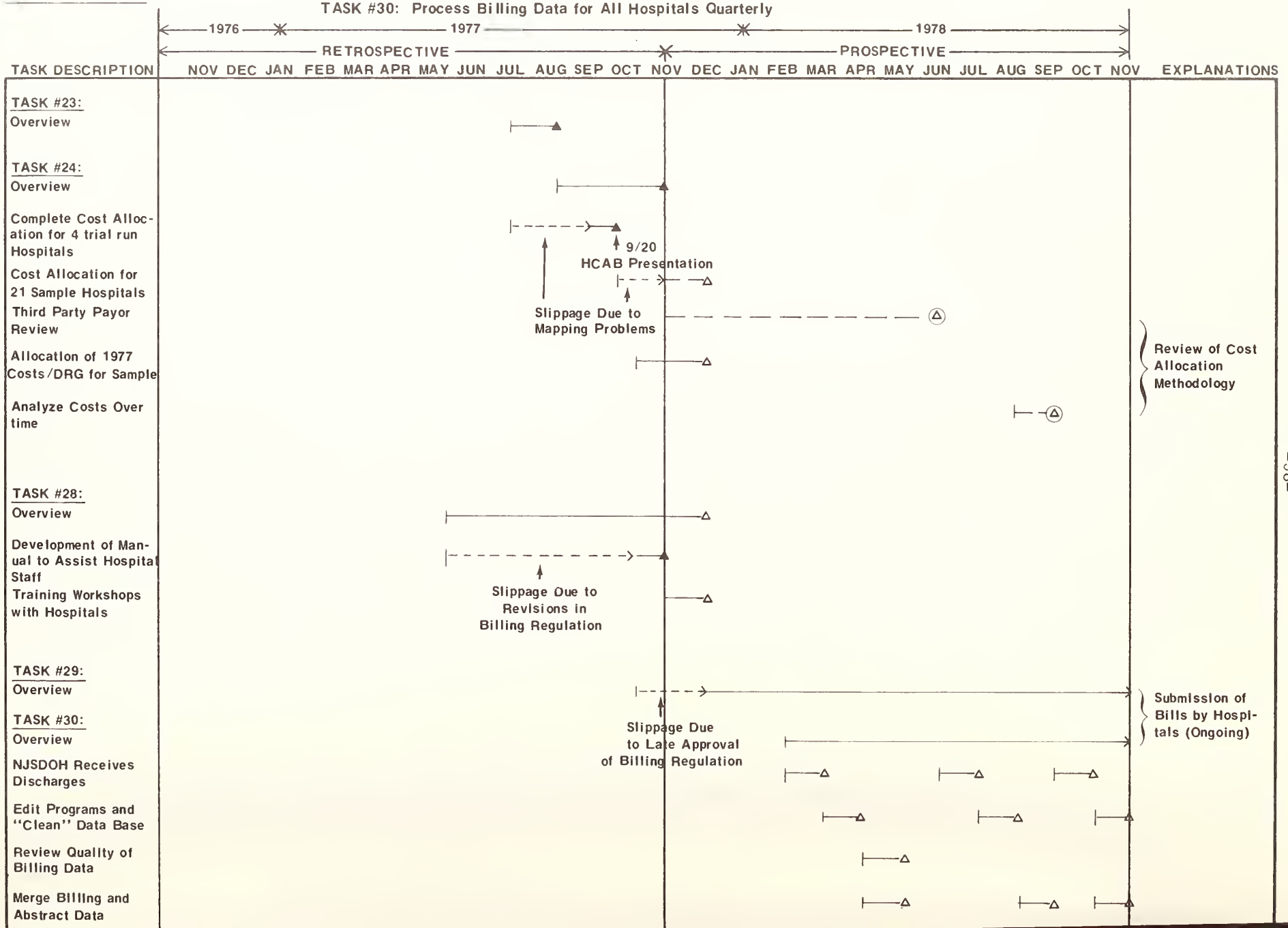


CHART 10:

Ancillary Services

TASK #31: System Transfer from Puter to NJSDOH
TASK #33: Allocate Equalized Cost to DRG for All Hospitals for Quarter's Data
TASK #41: Programming (Developmental and Maintenance)

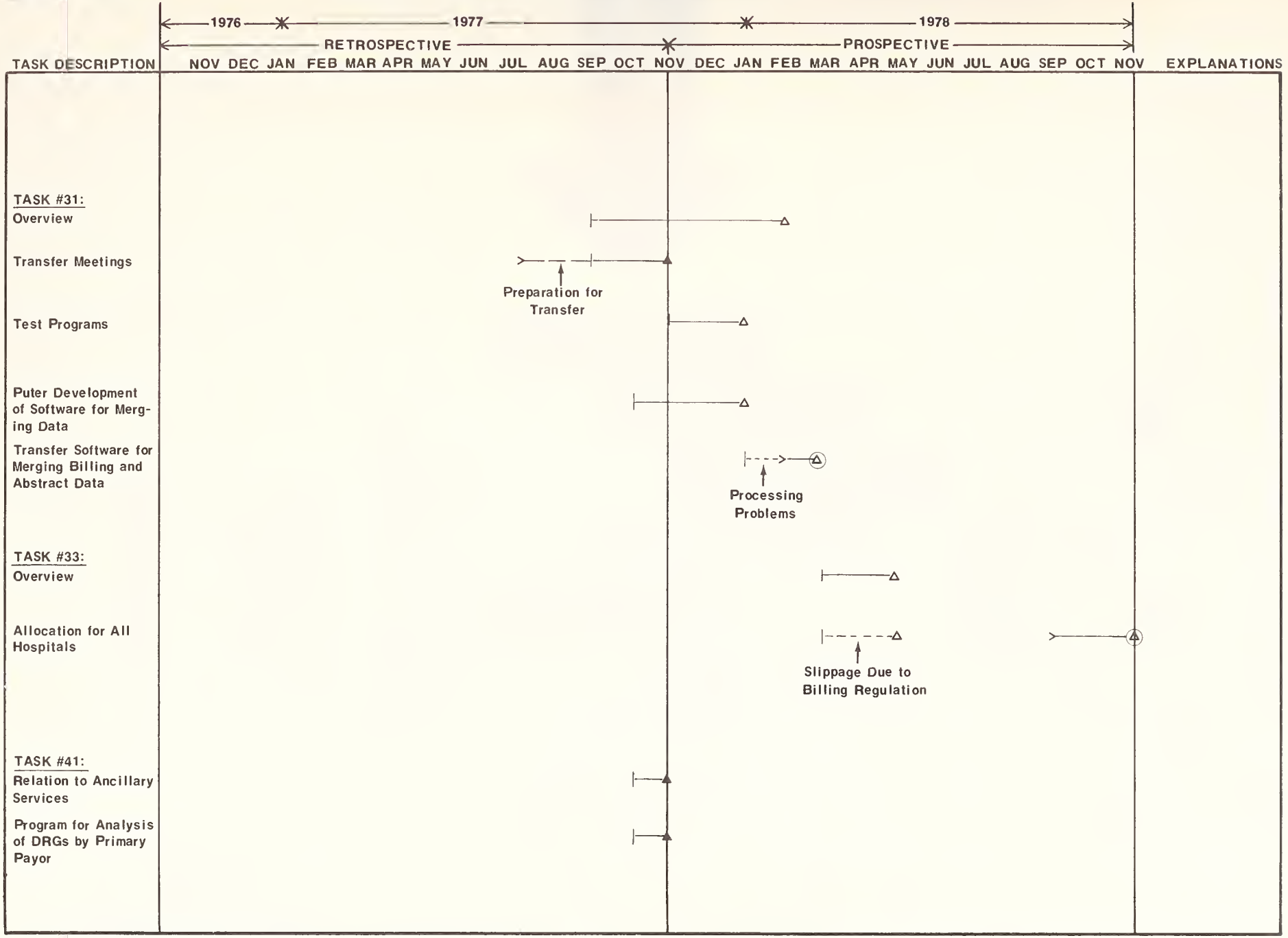


FIGURE 14: Nursing Services Component of Hospital Care Costs

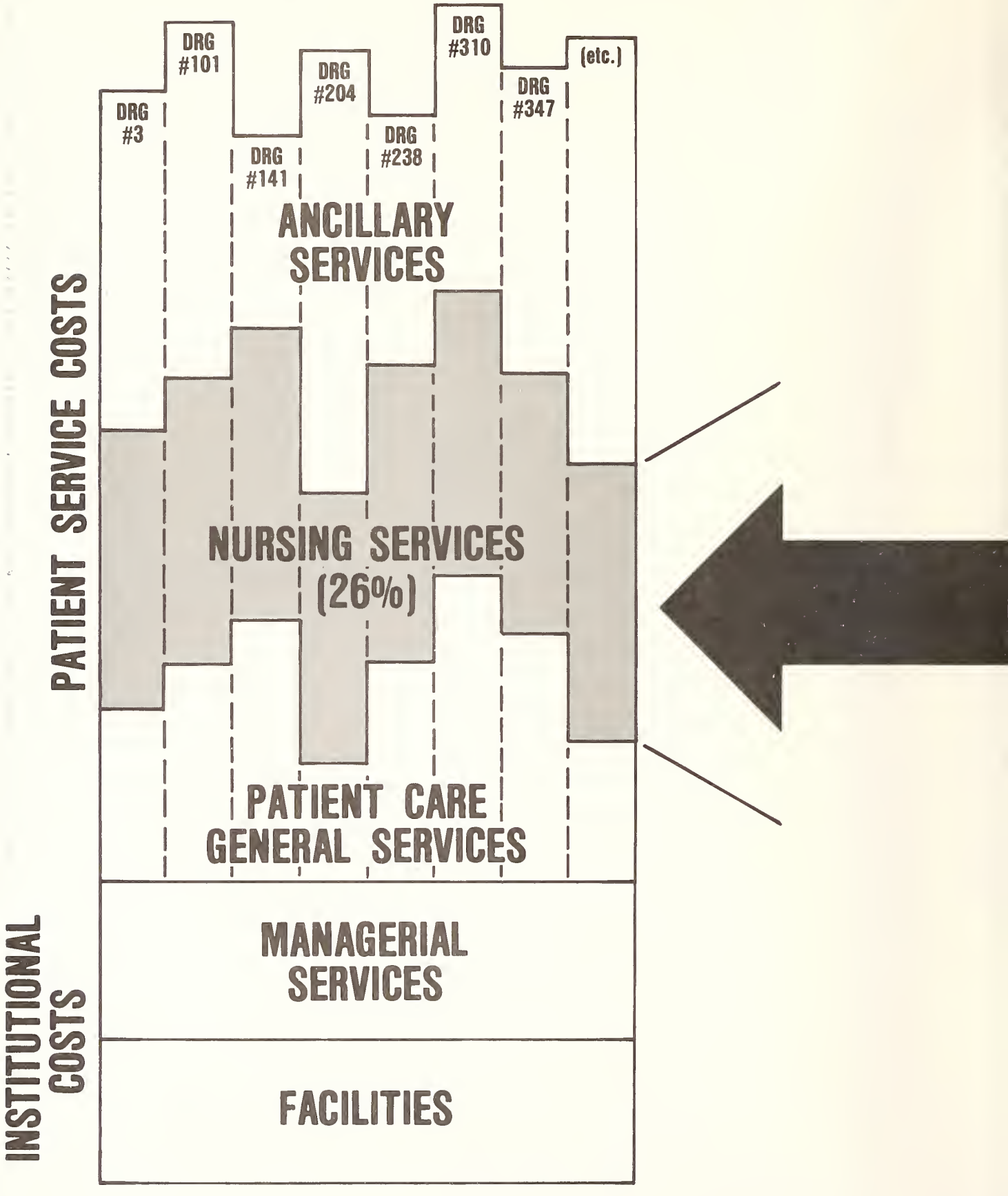
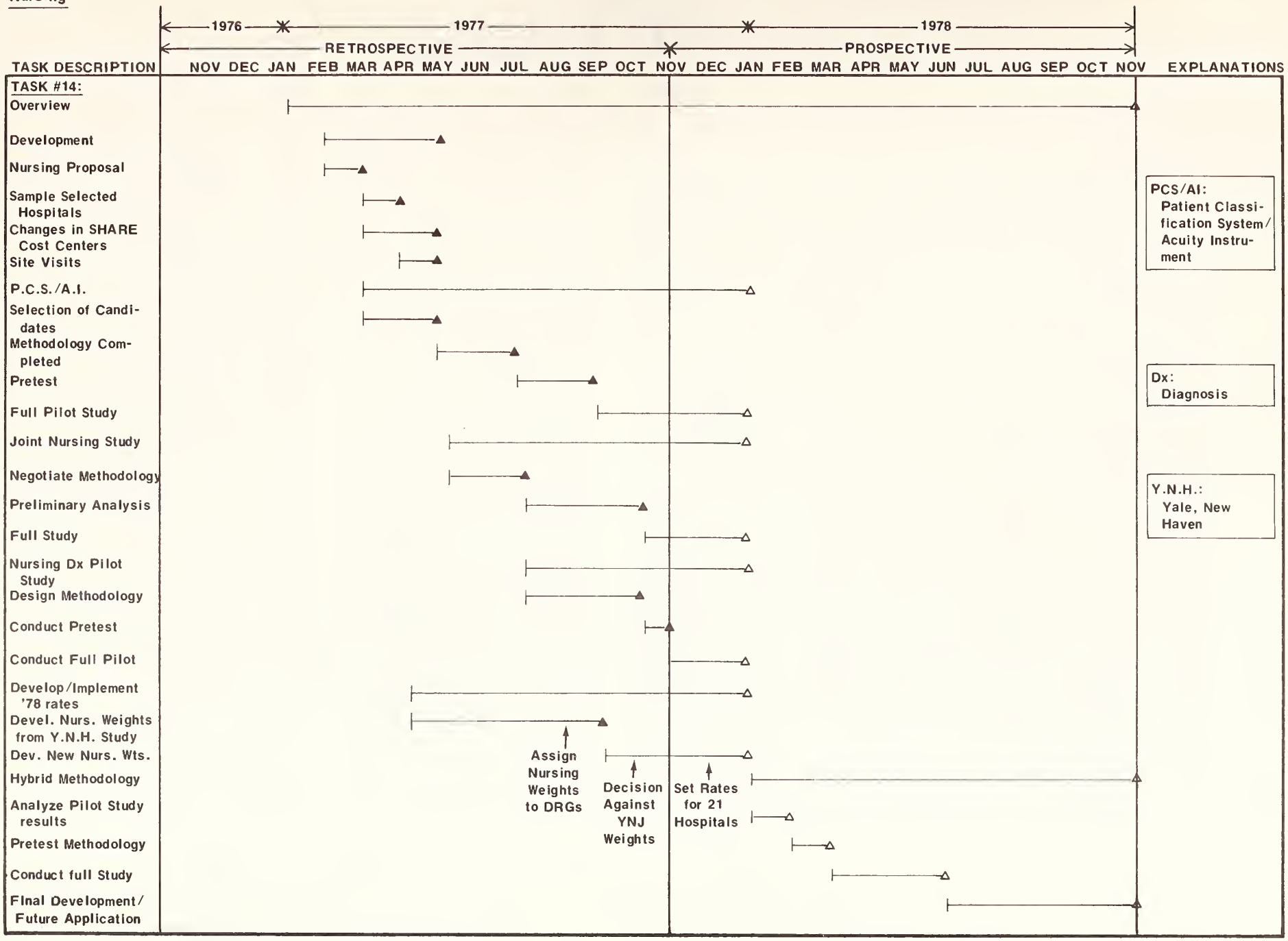


CHART 11:

Nursing

TASK #14: Nursing Intensity Study Per DRG



2. Nursing Services

The importance of the nurse in the delivery of patient care in the hospital cannot be overemphasized. With the trend towards physician specialization and sub-specialization and with the typical specialist finding less time for the primary care of the patient, the hospital nurse is assuming a greater role in the support of the patient and continuity of treatment. While the traditional stereotype of the nurse is that of a semi-professional helper who passively assists the physician and whose treatment role is often confined to "holding hands," rapid changes in nursing education and practice have dramatically altered the course of the nursing profession during the past 15 years. Nursing is rapidly evolving into a profession external to medicine, and is geared to providing the patient with the ability to better cope with health or disease states. As part of this emerging professionalism, nursing is expanding into various skill levels and clinical specialties. Nursing care has become more progressive involving expanded responsibilities for restoration, maintenance, and prevention. The nursing care process may now be conceptualized as involving not only the conventional interventions such as socio-emotional support, administration of the medical regimen, and health-teaching, but as including such progressive activities as nursing diagnoses and nursing quality assurance.

Unfortunately, these innovations in the practice of nursing in the hospital setting have not been paralleled by changes in the hospital reimbursement system. That is, expenses for nursing services continue to be recovered under room and board revenue. Nursing is subsumed under room and board simply because the system is not able to identify nursing services consumed by patients; thus, there are no charges for nursing services. Because of this situation, nursing budgets are often highly vulnerable to cuts by hospital administrators. In fact, the trend towards increased ancillary service costs may be partly attributable to administration's practice of reallocating disposable dollars from nursing services.

Refer to Figure 14 for the percentage of Nursing Service costs and Chart 11 for the Task directly related to Nursing Services.

A number of methods have been developed and employed in an attempt to construct more adequate nursing services cost accounting through the measurement of nursing activity.

Management and industrial engineering approaches have been used to quantify the intensity of nursing through the study of performance time and task frequency in the delivery of direct and indirect care. These approaches are quite popular and have been used by such groups as the Commission for Administrative Services in Hopsitals (CASH), the Community Systems Foundation (CSF), Formula Analysis and Control Techniques for Staffing (FACTS), and Management Engineering and Cost Control Service (MECCS). The usual output measure of these approaches is the number of nursing hours per patient per day. In addition to these traditional time-and-motion approaches, patient classification systems have been developed (and often incorporated into industrial engineering approaches) in an attempt to identify the intensity of nursing services corresponding to requirements displayed by patients placed into varieties of dependence, need, or acuity typologies. The most important developemental work for this mode of staffing and cost analysis was conducted by the Johns Hopkins Operations Group during the 1960's.

While these methods have been useful in helping administration to quantify nursing performance, forecast nurse staffing requirements, and to introduce a margin of control of nursing service costs, they all share an important weakness in internal validity: they are built upon the premise that nursing intensity and resource consumption are merely a function of patient census.

An innovative approach to the study of nursing resource consumption has been developed under a joint effort of the Center for the Study of Health Services at Yale University and Yale New Haven Hospital. This study is based upon the premise that the intensity of nursing services and their consumption by patients not only vary by the number of patients but by the mix of patients. Thus, this study is significant in its attempt to address the relationship between nursing utilization and patient illness in order to cost and reimburse nursing care by patient case-mix through DRGs. This is accomplished through the development of a Measure of Resource Use referred to as a Relative Intensity Measure (RIM).

Employing the basic case-mix concepts developed at the Yale-New Haven Hospital Study (but on an unprecedented scale given the size of the data base and the numerous hospital nursing care settings involved), the Project has designed and is currently testing three independent but complementary nursing pilot studies (i.e., Patient Classification System, Joint Nursing Performance Analysis, and Nursing Diagnosis) in an attempt to construct a hybrid methodology. The empirically developed hybrid will be used to generate RIMs for each of New Jersey's 383 DRGs which will reflect relative nursing costs by

nursing skill levels on a cost per case basis. The Nursing Study will provide hospital management with an empirically constructed tool by which nurse staffing levels may be variably built as a function of the mix of patients treated. The method will furnish management with important information regarding the types and amounts of nursing care requirements to meet a hospital's case-mix.

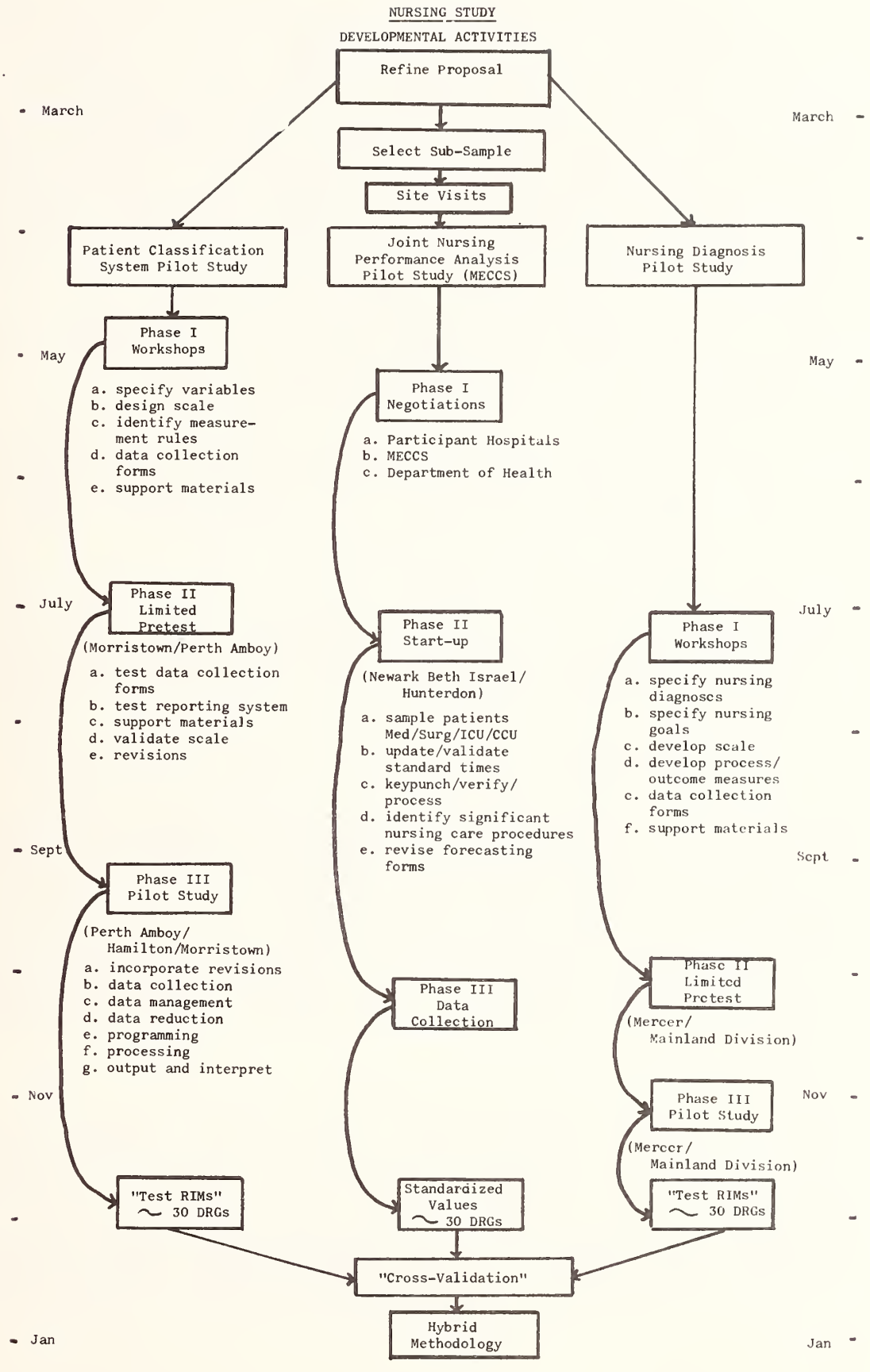
The developmental activities involving the design and execution of the Project's nursing pilot studies are depicted in Figure 15. For a detailed discussion of the activities and products produced during the past three contract reporting periods, refer especially to Second Quarter Report: Volume 1, pp. 46-48; Third Quarter Report: Volume 1, pp. 68-80; Third Quarter Report: Volume II, Appendix A-14h.

a. The Identification of Nursing Costs

As opposed to the traditional room and board classification of nursing costs, SHARE provides specific identification of nursing costs for reimbursement. SHARE sets cost screens at the cluster level (i.e, patient care services, ancillary services, and general services) with patient care services defined as nursing costs provided on patient care units. Because SHARE does not use a step-down methodology, reimbursement for hosptal nursing services is determined at the patient care cluster level in contrast to Medicare's room and board cost-finding classification.

In an attempt to further refine uniform reporting of nursing service costs, the Project has developed an alternative to the SHARE classification of nursing costs. For example, concerning Nursing Administration (NAD), problems emerged with nonuniform reporting because a floor supervisor might have been reported in the patient care cluster or in NAD which is a general service. There is a continuum of nursing responsibility from director of nursing to staff nurse, and various titles are used differently by various institutions for similar responsibility levels. Because of these inconsistencies, NAD will be apportioned to the nursing care units, ancillary services, and outpatient units which it serves. For 1978 rate-setting purposes, Medicare B-1 statistics (nursing hours of service) are being used to apportion NAD costs for the sample of 21 hospitals. Beginning with 1977 Actual cost reporting, the NAD cost center has been eliminated entirely; and the hospitals will be individually responsible for recasting this center.

FIGURE 15:


NURSING STUDY
DEVELOPMENTAL ACTIVITIES
Refine Proposal
March
March
Select Sub-Sample
Site Visits
Patient Classification System Pilot Study
Joint Nursing Performance Analysis Pilot Study (MECCS)
Nursing Diagnosis Pilot Study
Phase I Workshops
May
May
a. specify variables
b. design scale
c. identify measurement rules
d. data collection forms
e. support materials
Phase I Negotiations
a. Participant Hospitals
b. MECCS
c. Department of Health
July
July
Phase II Limited Pretest
(Morristown/Perth Amboy)
a. test data collection forms
b. test reporting system
c. support materials
d. validate scale
e. revisions
Phase II Start-up
(Newark Beth Israel/ Hunterdon)
a. sample patients Med/Surg/ICU/CCU
b. update/validate standard times
c. keypunch/verify/ process
d. identify significant nursing care procedures
e. revise forecasting forms
Phase I Workshops
a. specify nursing diagnoses
b. specify nursing goals
c. develop scale
d. develop process/ outcome measures
c. data collection forms
f. support materials
Sept
Sept
Phase III Pilot Study
(Perth Amboy/ Hamilton/Morristown)
a. incorporate revisions
b. data collection
c. data management
d. data reduction
e. programming
f. processing
g. output and interpret
Phase III Data Collection
Phase II Limited Pretest
(Mercer/ Mainland Division)
Nov
Nov
Phase III Pilot Study
(Mercer/ Mainland Division)
"Test RIMs" ~ 30 DRGs
Standardized Values ~ 30 DRGs
"Test RIMs" ~ 30 DRGs
"Cross-Validation"
Hybrid Methodology
Jan
Jan

There also exists considerable nonuniformity of cost reporting for classification along a continuum of Progressive Patient Care (intensive, acute, and subacute care). Because of the lack of consistency in licensing standards, "intensive care" may be defined quite differently among similar institutions. For example, coronary care step-down telemetry beds, patients, and nursing costs may be classified as intensive in one hospital and acute in another. Naturally, where a hospital puts such ill-defined areas into the more intense functional reporting unit, costs viewed on a per diem basis will appear deflated in both the more and the less intense functional reporting units. Referring to the example, patients who would be consuming more dollars per day than the average acute patient, but fewer dollars per day than the average intensive care patient, would obviously reduce the average per diem in both ACU and ICU by classifying them into ICU.

In order to furnish a more uniform functional reporting of nursing costs, the decision was made to use skill level-based cost centers for nursing (i.e., Registered Nurses (RNS), Licensed Practical Nurses (LPN), Attendants (ATT), and Clerical (CLR)). The fact that nursing services are provided by certain kinds of nurses to certain kinds of patients, and not from or to types of beds, provided the rationale for the nursing skill level cost center decision. The definitions of these cost centers and their respective reporting forms are included in Appendix I.B.9.a. For a more detailed account of this activity, refer to Second Quarter Report: Volume I, pp. 43-44.

b. 1978 Rate-Setting for Nursing Services

As originally reported in the Second Quarter Report: Volume I, pp. 44-45, and the Third Quarter Report: Volume I, pp. 112-116, the Project had decided to set rates for total inpatient nursing care costs to DRGs for the sample of 21 hospitals by using modified RIMs derived from the Yale-New Haven Hospital Study. The decision was made to use these nursing weights because of the lack of alternative empirical data, and the real time constraints which precluded the execution of a full scale nursing study in time for 1978 rate-setting.

However, in response to concerns raised by the New Jersey State Nurses' Association, the New Jersey Hospital Association, and representatives from the interdisciplinary Nursing Screens Advisory Committee about the ecological validity of the weights (Refer to Appendix I.B.9b for a chronicle of the events and special meetings.), and after considering a number of least objectionable alternatives, the decision was made to develop subjective nursing weights

through the participation of nursing administration and staff from the the 21 Participating Hospitals.[11] This would be achieved by means of a "Q-sort" technique. Given certain medical and nursing criteria, nurses would use their clinical expertise together with consideration of their hospital's practice characteristics to rank the 383 DRGs along an intensity continuum. This would be done independently at the 21 hospitals to best reflect their services and practices. Normalized values would then be developed after a statistical analysis of the independently generated subjective weights.

After having conducted a telephone survey and solicitation of nursing directors from the 21 participating hospitals (See Appendix I.B.9.c for the results of the telephone survey and a sample of the solicitation correspondence.), a 1978 Rate-Setting Nursing Workshop was conducted at the Department of Health during mid-October. During the workshop, the nurses were provided an overview of the DRG Prospective Reimbursement Project and instructed how to use the DRG-Sorting Kit for ranking the 383 DRGs along the intensity continuum. Among the criteria employed for the DRG sorting and ranking procedure were:

> Each DRG will be ranked according to the intensity of general nursing services that are required to meet the needs of the typical patient for the particular DRG. Nursing services are highly variable within the hospital based upon diagnosis, age, severity of illness, and unique need for specialized nursing knowledge. While these factors should be considered in ranking a DRG, the final net assessment of intensity of general nursing services should reflect the amount of direct and indirect care to treat the typical patient in a DRG. These rankings should reflect the kind and intensity of nursing practice as it actually exists in a particular hospital.

A more thorough discussion of the DRG sorting procedure criteria and rules together with samples of the DRG Cards are provided in Appendix I.B.9.d.

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11. Fred N. Kerlinger, Foundations of Behavioral Research (New York, 1964), pp. 582-598.

There are several statistical options that are being considered in the analysis of the DRG rankings for constructing normalized judgmental nursing weights. Depending upon the quality of the data returned from the hospitals and the stability of the rankings across all 21 hospitals, the approach will employ a paired-comparisons algorithm which generates RIMs consistent among all 21 hospitals. This algorithm will allow the construction of an interval-approximate scale for assigning nursing weights. Appendix I.B.9.e contains the paired-comparisons algorithm and operations for the Q-sort methodology. In an attempt to determine the degree of consistency of these weights, they will be cross-checked against the values of the Yale-New Haven Study RIMs across all 383 DRGs. For example, if the normalized weights developed by the Q-sort do indeed reflect the intensity of nursing services by DRGs, then their distribution should theoretically approximate a log-normal distribution.

Once these weights have been developed and tested for their validity and reliability, they will be used to set rates for total inpatient nursing care costs for the 21 hospitals by means of the following methodology:

- Given the 383 DRGs, their corresponding patient days and Q-sort developed weights, RIMs per admission by DRG may be determined.

- These RIMs may then be used as a Measure of Resource Use to disperse the total inpatient nursing care budget to DRGs for 1976 costs.

- For each DRG, the median inpatient nursing care cost from the sample of hospitals is determined and may be applied to the 1978 projected case-mix of each hospital.

- These dollars are then summed, an economic factor applied, and the 1978 projected inpatient nursing care budgets and DRG based reimbursement rates are determined.

- For each hospital, this budget may be broken down into four cost centers (RNS, LPN, ATT, and CLR) based upon the ratio of salaries each hospital realized in that breakdown for 1976 for informational purposes only.

c. Continuing Developmental Activities: The Nursing Pilot Studies and the Hybrid Methodology

(1). Patient Classification System/Acuity Instrument

The first pilot study, the Patient Classification System/Acuity Study, focuses upon the patient as the unit of analysis; and the patient is defined according to acuity of needs and corresponding intensity of nursing care required. The system consists of five nursing intervention dimensions (assessment/planning, health-teaching, emotional support, medical regimen, and physical/functional care) along a four point continuum (minimum, sub-acute, acute, and intensive). By use of a classification instrument corresponding to the above typology, the number of patient days per acuity level for each DRG may be determined. The classification will be made by the nurse responsible for the patient plan. Sufficient data will be collected to provide a ranking of the 30 most prevalent DRGs so that statistical comparisons may be made with the two other pilot studies. Patient classification and sub-classification per nursing dimension will provide baseline data so that RIMs may be assigned to each acuity level reflecting time needed to provide direct patient care by nursing level. Costs will then be assigned to the DRGs based on RIMs per realized inpatient days. Allowances will be made for indirect care and non-productive time based on data collected in the study. (For a more thorough discussion of this pilot, see Third Quarter Report: Volume I, pp. 73-79.)

The pretest of the Patient Classification System/Acuity Instrument was completed during August. While the primary purpose of the pretest was to analyze the decision rules, data collection forms, and the overall facility of the reporting system, data from the pretest were also examined for response trends and for the purpose of validating the Continuum of Patient Needs scale. For example, a statistical analysis of the "low-average-high" subcontinua within each of the four patient classifications (minimum, sub-acute, acute, and intensive) was conducted in order to determine the trade-off between the facility of using a 12-point scale and the response variance in rating patients' nursing needs. Table 4 shows the relative frequency of the use of the sub-continua. The utilization of these sub-continua appears to be sufficiently variable to justify their continued use as a component of the Continuum of Patient Needs scale.

The four general patient classifications (minimum, sub-acute, acute, and intensive) were also examined for overall response variability. While all four categories were anticipated to display good response variability, the expectation was that the lower acuity categories would be used more extensively than the intensive category for classifying patients. The relative frequencies of use shown in Table 5 support this expectation.

The above analyses seemed to indicate that the utility of employing both scaling schemes to develop a variable 12-point Continuum of Patient Needs scale was justified as shown in Table 6.

In addition to these descriptive analyses, a number of tests were conducted to validate some of the conceptual acuity properties of the Continuum of Patient Needs scale, i.e., the relationship between utilization (both actual and perceived need) by skill level and degree of acuity. The associations between the five Nursing Intervention Dimensions and the total time (actual reported time plus additional time desired) required to intervene by skill levels were investigated. The results are shown in Table 7. The rank-order correlations suggest that RNs tended to perceive the need for more RN total intervention time than was actually reported relative to the need for additional time of the other skill levels. These findings indicate that the relationship between RN total time and patients' acuity level requires additional analyses. Table 8 shows the association between actual reported time spent for each Nursing Intervention by skill level. The data indicate that differences between skill levels are not as great as expected. These results suggest a weakness in the Continuum of Patient Needs scale, since the scale should generally reflect significant differences in the time spent in each intervention by skill. This problem is currently being addressed and will involve some modifications in the reporting system in anticipation of the full pilot study.

In order to obtain direct feedback from the nursing staff who participated in the pretest of the Patient Classification System/Acuity Instrument, a Post-Test Evaluation Questionnaire was administered. (Appendix I.B.9.f) The questionnaire attempted to gather information from respondents regarding their experience with the Instruction Manual, data collection forms, decision rules, and the Orientation Sessions. (Refer to Third Quarter Report: Volume I, pp. 73-79; Third Quarter Report: Volume I, Appendix A-14.h.) The data provided by these questionnaires were analyzed in order to explore the interactions between respondent attributes (e.g., educational level) and reported ease or difficulty of use.

TABLE 4:
Patient Classification Pretest - Use of Sub-Continua

(Percentage of Use)
N=1508

Sub-Category	Assessment & Planning	Teaching	Emotional Support	Medical Treatment	Physical Needs
Low	30.1	33.0	32.3	38.1	32.2
Average	45.0	44.4	39.6	44.3	43.7
High	24.1	25.8	27.5	17.0	23.3

TABLE 5:
Patient Classification Pretest-Use of Basic Categories

(Percentage of Use)
N=1508

Category	Assessment & Planning	Teaching	Emotional Support	Medical Treatment	Physical Needs
Minimum	46.1	36.7	37.8	36.3	33.8
Sub-Acute	35.2	43.3	33.9	40.6	34.4
Acute	12.3	14.2	22.3	18.4	24.0
Intensive	5.6	5.0	5.4	4.0	7.0

TABLE 6:
Patient Classification Pretest--Use of Full Twelve Point Scale

(Percentage of Use)
N=1508

Category	Assessment & Planning	Teaching	Emotional Support	Medical Treatment	Physical Needs
1) Minimum-Low	17.9	16.7	15.5	18.7	13.3
2) Minimum-Average	20.4	14.0	15.2	13.5	15.3
3) Minimum-High	7.8	6.3	7.1	4.1	5.2
4) Sub-Acute-Low	7.8	10.8	8.6	13.1	9.5
5) Sub-Acute-Average	18.0	20.1	15.1	21.4	16.8
6) Sub-Acute-High	9.5	12.7	10.2	6.2	8.2
7) Acute-Low	3.3	5.0	6.6	5.9	8.0
8) Acute-Average	5.6	5.1	8.4	8.4	9.7
9) Acute-High	3.4	4.2	7.3	4.0	6.2
10) Intensive-Low	1.1	0.7	1.6	0.4	1.5
11) Intensive-Average	1.1	1.5	0.9	1.0	1.9
12) Intensive-High	3.4	2.8	2.9	2.7	3.7

TABLE 7:
Patient Classification Pretest--Rank Order Correlations* between Nursing Intervention Dimension Total Times (Actual Time and Additional Time Desired) and Skill Levels

N=1508

	Assessment & Planning	Teaching	Emotional Support	Medical Treatment	Physical Needs
RN Time	.291 ($p<.0001$)	.299 ($p<.0001$)	.317 ($p<.0001$)	.311 ($p<.0001$)	.323 ($p<.0001$)
LPN Time	.140 ($p<.0001$)	.055 ($p<.0008$)	.105 ($p<.0001$)	.135 ($p<.0001$)	.154 ($p<.0001$)
ATT Time	.050 ($p<.0007$)	.019 (NS)	.094 ($p<.0001$)	.097 ($p<.0001$)	.100 ($p<.0001$)

*Kendall's Tau C

Tables 9 and 10 illustrate the distribution of responses to questions dealing with the reported degree of difficulty in the comprehension and use of the components of the Patient Classification System/Acuity Instrument and with participation in the Orientation Sessions. In the aggregate, the responses indicated low to moderate difficulty in comprehension and use.

Based upon these statistical analyses, staff monitoring and problem-solving efforts, and reviews by representatives of the Nursing Screens Advisory Committee, revisions were made in the Patient Classification System/Acuity Instrument, data collection forms, the Instruction Manual, and the Orientation Session Notebook in preparation for the full pilot study. (Refer to Appendix I.B.9.g.)

During the period of September through January, the full pilot study of the Patient Classification System/Acuity Instrument will be executed at Morristown Memorial Hospital, Perth Amboy General Hospital, and Hamilton Hospital. Extensive data collection control and data management have been instituted to minimize the occurrence of such problems as reporting delinquency, fatigue, and projection. Special orientation sessions and practice periods have been initiated with emphasis upon early problem identification and resolution. These activities are being maintained through the employment of part-time data monitors and staff in-service education liaisons. In addition, interim evaluations and weekly progress reports are prepared by Project staff.

(Refer to Appendix I.B.9h for products and correspondence relating to these activities.)

Because of the tremendous volume of data that are being generated, the data collection forms will be reduced to card input under separate contractual arrangements with independent vendors. (See Appendix I.B.9.i for "Specification for Data Preparation Services.") Management Services of the Department of Health will be assuming responsibility for the keypunching of data submitted by participating medical records departments. (Appendix I.B.9.j.)

TABLE 8:
Classification Pretest--Rank Order Correlations* between Nursing Intervention Dimension and Actual Time by Skill Level

N=1508

	Assessment & Planning	Teaching	Emotional Support	Medical Treatment	Physical Needs
RN Actual Time	.213 ($p<.0001$)	.197 ($p<.0001$)	.294 ($p<.0001$)	.216 ($p<.0001$)	.217 ($p<.0001$)
LPN Actual Time	.219 ($p<.0001$)	.089 ($p<.0001$)	.173 ($p<.0001$)	.208 ($p<.0001$)	.230 ($p<.0001$)
Attendant Actual Time	.143 ($p<.0001$)	.121 ($p<.0001$)	.167 ($p<.0001$)	.178 ($p<.0001$)	.188 ($p<.0001$)

*Kendall's Tau C

TABLE 9:
Classification Pretest--Responses to "Difficulty" Questions on Post-Test Evaluation Questionnaire

(Absolute Frequency of Responses)
N=74

Difficulty in Understanding	No Difficulty	Some Difficulty	Difficulty in Use	No Difficulty	Some Difficulty
Acuity Category Descriptions	36	38	Fitting patient to Acuity Category	34	40
Nursing Intervention Dimensions	63	11	Matching Actual Practice to Intervention Dimensions	55	19
Procedure for Reporting Time Spent with Patient	68	6	Reporting Actual Time	54	20
Procedure for Estimating "Additional Time Desired"	49	25	Estimating Additional Time Desired	46	28
Data Forms and Worksheets	69	5	Using Data Collection Forms and Worksheets	72	2
Instruction Manual	60	14	Using Instruction Manual	67	7
Other Difficulties	66	8	Other Difficulties	71	3

TABLE 10:
Responses to Selected Items from the Post-Test Evaluation Questionnaire

(RNs' Reported Degree of Difficulty by Relative Frequencies)

(N=74)

Item 15a: In general, how adequate was the orientation session in helping you to understand the instrument?

19% - very adequate

54% - somewhat adequate

15% - not very adequate

03% - not adequate at all

09% - no response

Item 15b: In general, how adequate was the orientation session in helping you to understand the reporting procedures?

19% - very adequate

64% - somewhat adequate

07% - not very adequate

01% - not adequate at all

09% - no response

Item 17: In general, how difficult did you find the Patient Classification System/Acuity Instrument to use?

26% - not difficult at all

65% - somewhat difficult

09% - very difficult

0% - impossible

(2). Joint Nursing Performance Analysis Pilot Study

The Joint Nursing Performance Analysis Pilot Study is the second of the three complementary approaches being undertaken, and represents a mutual effort between the Project and Management Engineering and Cost Control Service (MECCS) of the American Hospital Association's Hospital Research and Educational Trust. This pilot is geared to the development of test RIMs by traditional industrial engineering techniques for statistical comparison to RIMs constructed by the Project's other pilot studies. (For an outline of the development of this pilot study, refer to Second Quarter Report: Volume I, pp. 43-46; Second Quarter Report: Volume II, Appendix A14-f; Third Quarter Report: Volume I, pp.70-72; Third Quarter Report: Volume II, Appendix A14-M.)

During this reporting period, negotiations between the Department of Health, MECCS, Newark Beth Israel Medical Center, and Hunterdon Medical Center were consummated. (Appendix I.B.9.k) Meetings were held between principal investigators from the Project and MECCS in order to determine the appropriate modifications in MECCS's methodology and data collection forms for case-mix linkup. (See Appendix I.B.9.l for minutes of these meetings and products generated.) In addition, data management and monitoring efforts were initiated, problem areas mutually resolved, monthly progress reports submitted and reviewed, and liaisons created between Project staff and participating medical records departments which generated data for DRG construction. (See Appendices I.B.9.m and I.B.9.n.)

Data from the Joint Nursing Performance Analysis Pilot Study is currently being collected by personnel from MECCS involving:

1. Hunterdon Medical Center

    a. three MED/SURG floors
    b. Continuing Care Facility (CCF)
    c. Intensive Care/Coronary Care Unit (ICU/CCU)

2. Newark Beth Israel Medical Center

    a. nine MED/SURG units
    b. Intensive Care Unit
    c. Coronary Care Unit
    d. Intermediate Care Unit
    e. Oncology unit

The core of the MEECS nursing methodology consists of properly determining the significant care items[12] to consider in each nursing unit, and then assisting nursing supervisors in forecasting the significant items on a daily basis. Data generated will be used to determine the number of hours required per patient for each skill level (RN, LPN, ATT) per shift per day for the entire length of stay. The Project will use these nursing care hours to establish average nursing times required for each DRG by skill level. These times may then be used as RIMs for allocating nursing costs to each DRG.

The method of calculating hours per patient per shift for each nursing skill level is accomplished by means of the following steps:

- Each significant task has an empirically determined time associated with it in hours per day.

- Each time a significant task is performed, it is checked, and its time is added to the patient's time requirement for the day.

- Generic tasks (tasks performed by any skill level) must be added to the task times associated with skill levels to calculate the task time for that skill level.

(Appendix I.B.9.o contains the master list of empirically determined significant tasks by skill level and unit with corresponding hours of care per day for the participating hospitals. Appendix I.B.9.p shows the calculated base times and other statistics for the nursing units.)

Specifically, the formula used for calculating the hours per patient per shift for each skill level is as follows:

$$N_{sl} = [(X_1 + C + X_2) \cdot K \cdot f_{sd}] + [(f_{ms} + X_3 + X_4)/X_5]$$

where:

N_{sl} = Hours per patient per shift (by skill level)

X_1 = Significant care time

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12. Significant care items are defined as those nursing procedures which require a significant amount of time each time they are performed, or which are performed so repetitively that the total amount of time spent becomes significant. The nursing care time to be spent on each patient consists of a base time (a constant time for each patient in a given nursing unit), plus variable significant care time which differs from patient to patient and from day to day.

C = Base time in hours

X_2 = Additional time in hours spent in treating patients over age 65

K = Rounding factor (preserves staff requirements in integer numbers)

f_{sd} = Shift distribution factor (allocates the times estimated on a 24-hour basis to each of the 8-hour shifts)

f_{ms} = Minimum staff factor (used for the night shift when the unit census falls below a given level)

X_3 = Supervision time (time spent by nursing supervisors which would not normally be accounted for by merely studying direct patient care)

X_4 = Clerk time

X_5 = Patient census for the unit

(3). Nursing Diagnosis Pilot Study

By far the most innovative and developmental of the three pilot studies, the Nursing Diagnosis Pilot Study employs a sensitive methodology which allows the direct measurement of nursing quality in terms of process (type and degree of nursing interventions) and outcome (magnitude and direction of the patient's illness condition for the duration of the hospital stay). Since the classification of patients into DRGs is based upon the statistical analysis of salient predictors such as medical diagnoses and procedures, the Nursing Diagnosis approach permits the identification of nursing resource consumption by nursing diagnoses which complement the DRG medical and surgical basis. (For a complete background of the development of this pilot, see Second Quarter Report: Volume I, p. 46; Third Quarter Report: Volume I, pp. 70-71 and 80.)

During the months of July through October, Nursing Consultant Workshops were held exclusively to assist Project staff to refine the nursing diagnoses, to construct data collection forms, to develop a workable scale and decision rules, and to draft instruction manuals. Appendix I.B.9.q contains minutes of the workshops together with products rendered.

A nursing diagnosis is theoretically defined as "a judgement or conclusion that occurs as a result of nursing assessment."[13] Table 11 depicts a taxomony of 28 nursing diagnoses listed alphabetically. These diagnoses were culled from the list of 37 "accepted" and 19 "provisional" nursing diagnoses identified at the National Conferences on Classification of Nursing Diagnoses.[14] This final list was generated after consolidation and elimination of commonalities among the original theoretical set of 56 nursing diagnoses.

The Nursing Diagnosis Instrument records the daily assessment of each patient along each of the 28 plausible nursing diagnoses to determine the nature and extent of health problems which fall within nursing practice. This approach is significant because it represents a departure from the task-centered analysis of nursing services towards problem-oriented nursing. The Nursing Diagnosis Instrument employs a seven-point scale which measures the intensity of the patient's need as changes in physical, physiological, emotional, psycho-social, and environmental properties along the appropriate nursing diagnoses. This need occurs in response to the stress of an impending or actual health problem and/or treatment, and is perceived to affect the well-being of the patient.

This seven-point continuum ranges from low to high-high. Low is defined as being synonymous with "normal or no change," and represents the ultimate goal towards which nursing strives to move and maintain the patient. High-high is defined as the level of need at which symptoms are extreme, exaggerated and/or even life-threatening. For a complete list of the operational definitions of the 28 nursing diagnoses, see the Key for Scaling on pp. 25-52 in Appendix I.B.9.r.

The Nursing Diagnosis Instrument employs the following three data collection forms:

- Assessment and Planning Record serves as a planning record which reflects professional nursing judgments. This data collection form is utilized by the responsible nurse on the day shift to list by number the diagnoses assessed and/or reassessed where there is deviation or potential for deviation from normal, the dates of such assessment and/or reassessment, the goals established and/or revised, explicit instructions specific to the nursing diagnosis, and to indicate dates on which particular nursing interventions were discontinued. This form allows the collection of nursing process data for quality measurement.

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13. Kristine M. Gebbie and Mary Ann Lavin, eds., Classification of Nursing-Diagnosis: Proceeding of the First National Conference (St. Louis, 1975) p. 114.

14. Kristine M. Gebbie, Summary of the Second National Conference: Classification of Nursing Diagnoses (St. Louis, 1976).

TABLE 11:
List of 28 Nursing Diagnoses

1. Ability to set health-care goals
2. Anxiety/fear level
3. Assertive/aggressive behavior
4. Body image
5. Cardiovascular function/activity
6. Comfort level
7. Communication pattern
8. Consciousness, level of
9. Coping behavior, family/significant other
10. Environment, family/home
11. Fluid-electrolyte levels
12. G.I. function/activity
13. Grieving
14. G.U. function/activity
15. Immunologic function/activity
16. Knowledge of heatlh-care regimen
17. Manipulation
18. Mobility
19. Nutritional pattern
20. Parenting behavior
21. Orientation, level of
22. Respiratory function/activity
23. Self-acceptance/role identification
24. Self-care activity
25. Sensory functioning
26. Sexual function/activity
27. Skin integrity
28. Sleep/rest activity

- Daily Progress Graphic Record is used by the responsible nurse on the day shift to assign scores from the seven-point continuum for each and every diagnosis assessed and found relevant. Through the daily assignment of scores and the plotting of coordinates to reflect changes, measures of outcome of the nursing process are obtained.

- Unit Weekly Record is designed as a log of the patient's movement throughout the course of his stay.

Refer to Appendix I.B.9.r for the Nursing Diagnosis Instrument Pretest Instruction Manual which contains samples and explanations for use of the data collection forms.

During November, a limited pretest of the Nursing Diagnosis Instrument will be conducted at Mercer Medical Center and Mainland Division of Atlantic City Medical Center. The pretest will occur over a two-week period and will involve the assessment of a total of 100 patients from MED/SURG, ICU and Psychiatry.

The data collected from the pretest together with post-test evaluations will be used to assess the degree of impact the reporting process had on the delivery of direct patient care, and to determine the reliability and practicality of the scale. After the analysis of the data generated during the pretest, the appropriate modifications will be introduced in the instruments and Manual in preparation for the full pilot study scheduled for late November to January. (Refer to Chart 12 for the Programing time lines.)

(4). Hybrid Methodology

At the completion of the three pilot studies scheduled for the end of January 1978, the methods for developing test RIMs and nursing quality measures for selected DRGs will be assessed for their impacts upon manpower, cost, reliability of the scales, internal validity, and ease of use. (See Appendix A14-m, Third Quarter Report: Volume II.) The results of these analyses will be used to construct a hybrid methodology incorporating the best of the three approaches for future rate-setting purposes. This Hybrid Nursing Study will be conducted at a scientifically selected sample of hospitals and nursing units during the period of February to June, and will involve extensive pretests and statistical analyses leading to the development of RIMs for all 383 New Jersey DRGs.

CHART 12:

Nursing

TASK #41: Programming (Developmental and Maintenance)

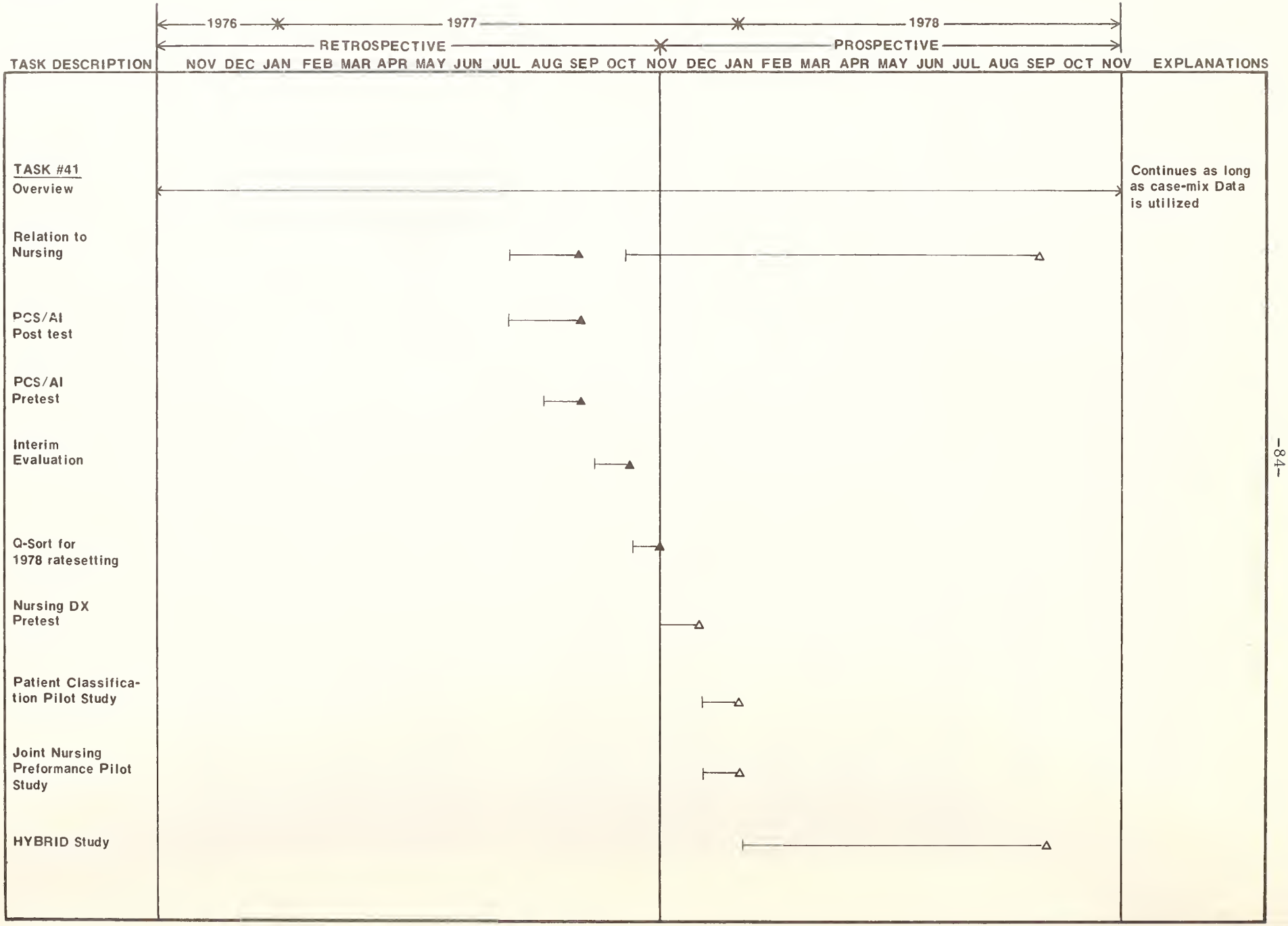


FIGURE 16: Patient Care General Services Component of Hospital Care Costs

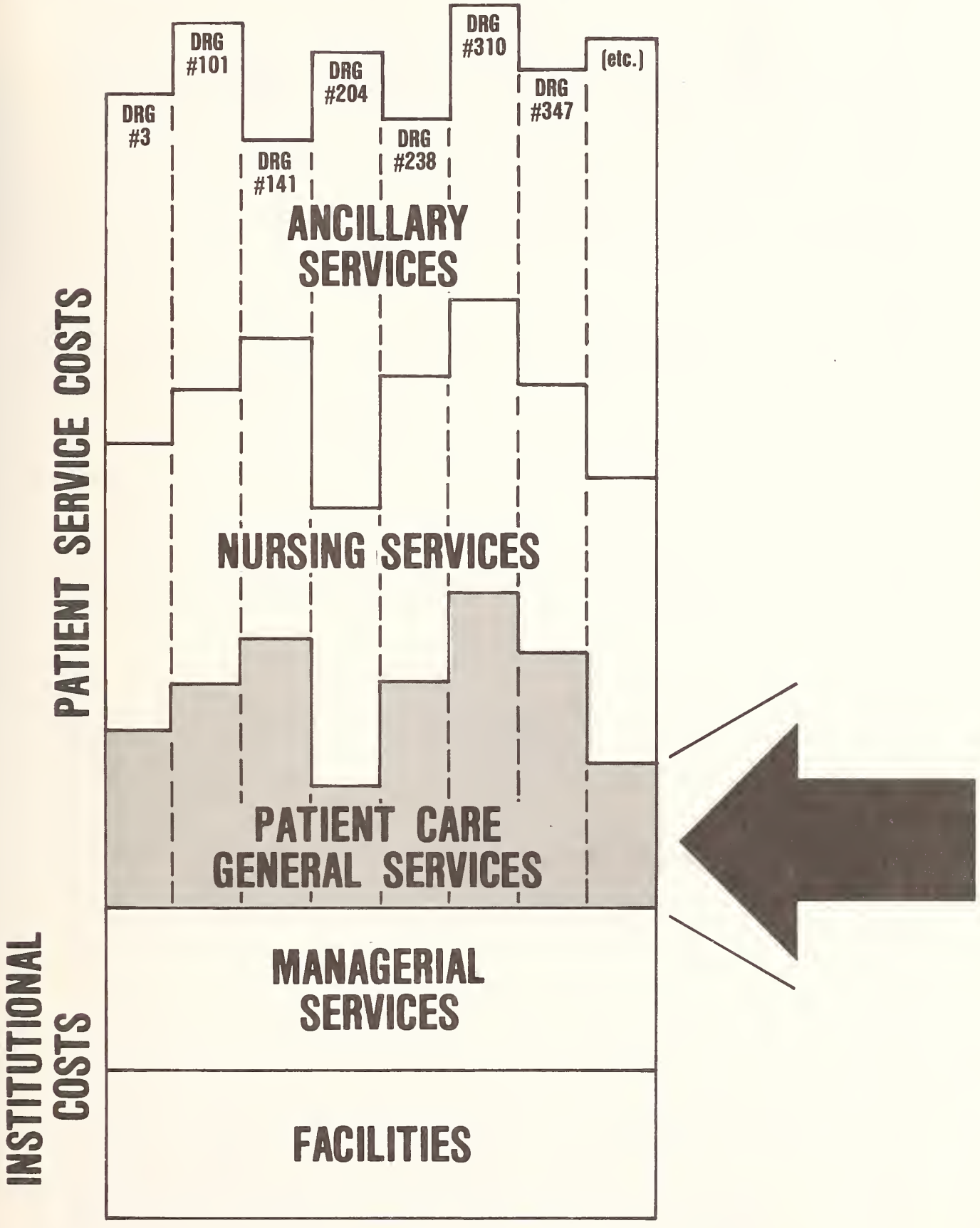
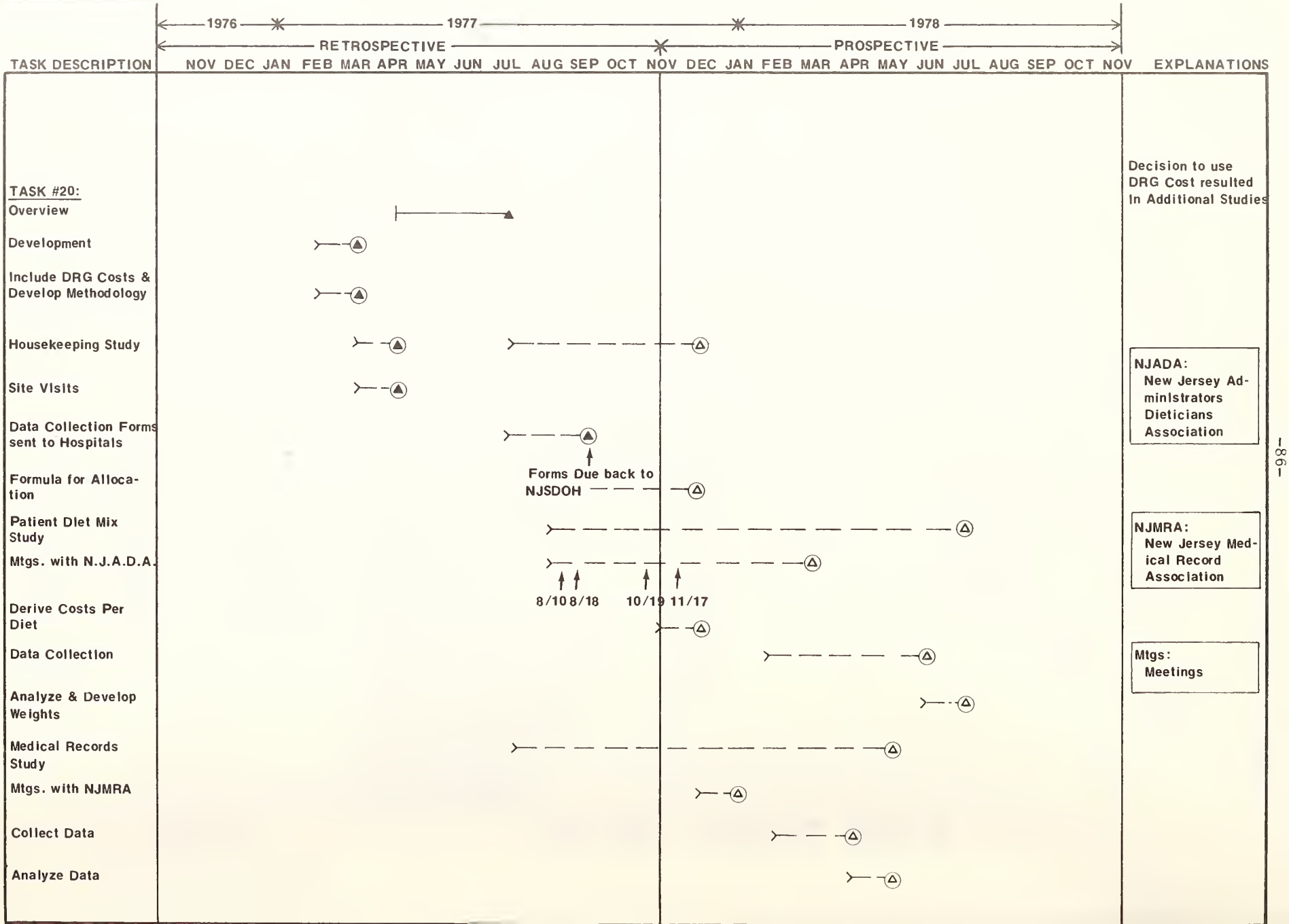


CHART 13:

Patient Care General Services

TASK #20: Establish RCC for Ancillary Cost Centers for Sample of Hospitals



3. Patient Care General Services

General services as classified by SHARE are services provided by a hospital in addition to ancillary and nursing services (in other words, the residue of room and board costs which remain when nursing costs are removed). Included are several cost centers which provide services directly to patients, such as nursing, but which do not directly charge for their services. Other general services provide the infra-structure of a hospital within which the provision of direct patient care takes place, such as Plant Operation and Administration. (Figure 16)

After considerable discussion (See First Quarter Report: Volume I, pp. 43-44, and Second Quarter Report: Volume I, pp. 63-64, and Volume II, Appendices 20a, 20b, and 20c), the Project decided that where a general service was involved in patient care and might be sensitive to fluctuations in patient case-mix, the service would be included in the Case-Mix Model. Four such services were identified and appropriate Measures of Resource Use were developed. After careful consideration, a fifth general service cost center involved in patient care, Patient Care Coordination, was not included in the Case-Mix Model for reasons set forth below. Discussion of each of the five cost centers follow. (Refer to Chart 13 for the task directly related to Patient Care General Services.)

a. Dietary Services

The provision of dietary services in hospitals is a complex process, matching the patient with the diet prescribed by a physician. In recent years, therapeutic dietetics has evolved into another segment of the health care team involved in improving the well-being of the patient.

The relationship between hospital dietary costs and case-mix is complex; surgical patients typically do not receive meals the day of surgery; various illnesses require different diets (e.g., low sodium, high protein, clear liquid) which vary in raw food expense; certain conditions require highly expensive supplemental tube feedings, and illnesses such as diabetes require extensive teaching by professional dieticians.

A Patient Diet-Mix Study Committee has been formed between Project personnel and the New Jersey Administrative Dieticians Association. The SHARE definition of the Dietary Service cost center is currently under review by this Committee in order to provide a functional definition consistent with those of the American Society of Hospital Food Service Administrators and Hospital Administrative Services. Beginning in February 1978, for a period of 60-90 days, a secondary analysis of dietary record cards will be conducted for each inpatient at the participating institutions. Each dietary record card contains

a patient's medical record number and diet by day of stay. This medical record number furnishes a link to the discharge abstract, and hence, to DRGs.

Five bench mark diets are currently being costed across a Monday through Thursday time frame for six participating hospitals in order to develop relative weights for raw food costs by diet:

- house/regular diets
- low sodium 800 mg.
- 1500 caloric restricted diabetic with snack
- low fat 40 grams
- clear fluid

Tube feeding products are also being analyzed as to their costs across these hospitals.

DRGs with insufficient data will be assigned typical diets by a committee of dieticians. The association between the frequency and duration of therapeutic dietician visits with diets is currently being analyzed by the Patient Case-Mix Dietary Committee. In this manner, Relative Diet-Mix Weights will be determined as the Measure of Resource Use for Dietary Services.

b. Housekeeping

Housekeeping is a service often overlooked as a component of patient care. Housekeeping plays a key role in the prevention of nosocomial infections. Executive housekeepers at four Experiment II hospitals were interviewed in March by Project personnel as to their views regarding whether housekeeping costs fluctuate with patient case-mix. Their responses were unanimous and highly affirmative. As a result of these interviews, the study of the relationship between housekeeping costs and patient case-mix is being pursued.

The definition of Housekeeping provided by SHARE calls for the recasting of Housekeeping costs to Operating and Recovery Rooms, Delivery and Labor Rooms, and Newborn Nursery (not used as a Nursing cost center by the Project). For future reporting as well as for the Experiment hospitals, these costs will be functionally reported in Housekeeping. Utilizing Medicare Step-down statistics, the costs of Housekeeping will be allocated among the various hospital areas the department serves. Where Housekeeping is apportioned to Institutional cost centers, it will be combined with Plant costs and evaluated by peer grouping on a per square footage basis. Where Housekeeping costs are apportioned to ancillary services or patient care general services cost centers, these resources will be allocated to DRGs by the Measure of Resource Use of the

respective service. These Housekeeping costs will not be added to the costs of each ancillary service, but rather, retained as direct Housekeeping consumed by the patient group. Thus, surgical patients will be apportioned a part of the Housekeeping of the Operating Room while medical patients will not. Housekeeping apportioned to patient care unit will be allocated to patients based on a formula (See Appendix II.A.) which takes into consideration: (a) differences between routine daily cleaning and the more time-consuming discharge or transfer cleaning (Short stay patient consume more housekeeping costs per diem than do long-stay patients.), (b) the greater housekeeping needs of isolation patients, and (c) differing cleaning practices among MED/SURG units, Intensive Care Units, and Nurseries. The latter factor is obtained from Medicare statistics, and the former two factors (a, b) are being derived from the results of a survey of the 21 Experiment II hospitals. (A copy of the survey is presented in Appendix I.B.7 and results in Appendix I.B.8.) The various components of Housekeeping are then recollected for the patient service areas by patient, and hence, DRG. In this manner, patient care Housekeeping can be evaluated by the needs of the patients it serves, rather than the square footage of the patient care service areas.

c. Laundry and Linen

The association of Laundry and Linen costs with patient case-mix is similar to Housekeeping, although not so complex. Because the consumption of Laundry and Linen services may vary with the use of ancillary services such as the OR, or with the patient's status as newborn infant or an intensive care patient, this service will also be allocated to DRGs. As with Housekeeping, Laundry and Linen costs will be spread to ancillary services and apportioned to patients based on their consumption of that service as determined by the appropriate Measure of Resource Use. Laundry and Linen costs allocated to Acute Care, Intensive Care, or Newborn Nursery units will be apportioned to patients based on length of stay within the respective unit. These various segments of Laundry and Linen costs will then be recollected to produce a Laundry and Linen cost per patient and per DRG.

d. Medical Records

Medical Records provides a valuable patient care service rarely seen by the patient. It is quite likely that the amount of Medical Records time spent on a patient's record varies with case-mix. The amount of record keeping corresponding to processing time spent on a terminal cancer patient's record should differ from that spent on an appendectomy patient's chart. While a large percent of this variance may be accounted for by length of stay, one might expect to find that fixed set-up times for each record are involved in addition to

the variable time attributable to length of stay. For the Experiment II hospitals, a factor of admission plus weeks of stay per patient (established judgmentally by medical records personnel in the Yale-New Haven Hospital case-mix study) will be used to control for this effect.

In order to more fully understand the relationship of case-mix with Medical Records resources, an in depth study is being planned with the New Jersey Medical Records Association (NJMRA). (See Third Quarter Report: Volume III, Appendix 20e.) A meeting between Project staff and NJMRA representatives examined the various functions typically involved in hospitals' medical record departments with regard to their inclusion or exclusion in the SHARE definition of Medical Records and their sensitivity to case-mix. In addition to the processing and abstracting of medical records, hospital tumor registries should be considered. The NJMRA will co-sponsor a study to develop a Measure of Resource Use by DRG; the exact methodology is currently under consideration.

e. Patient Care Coordination

Patient Care Coordination is a general service defined by SHARE to include hospitals' quality evaluation and utilization review activities, including costs associated with PSRO activities, preadmission testing, and social services. While these services are certainly of a patient care nature, the use of Patient Care Coordination resources would seem to fluctuate more with a hospital's commitment to these areas rather than case-mix. Hence, the determination of reasonable reimbursement for Patient Care Coordination activities will not be determined with the confines of the Case-Mix System, but will be treated as an institutional cost.

FIGURE 17: Institutional Cost Component of Hospital Care Costs

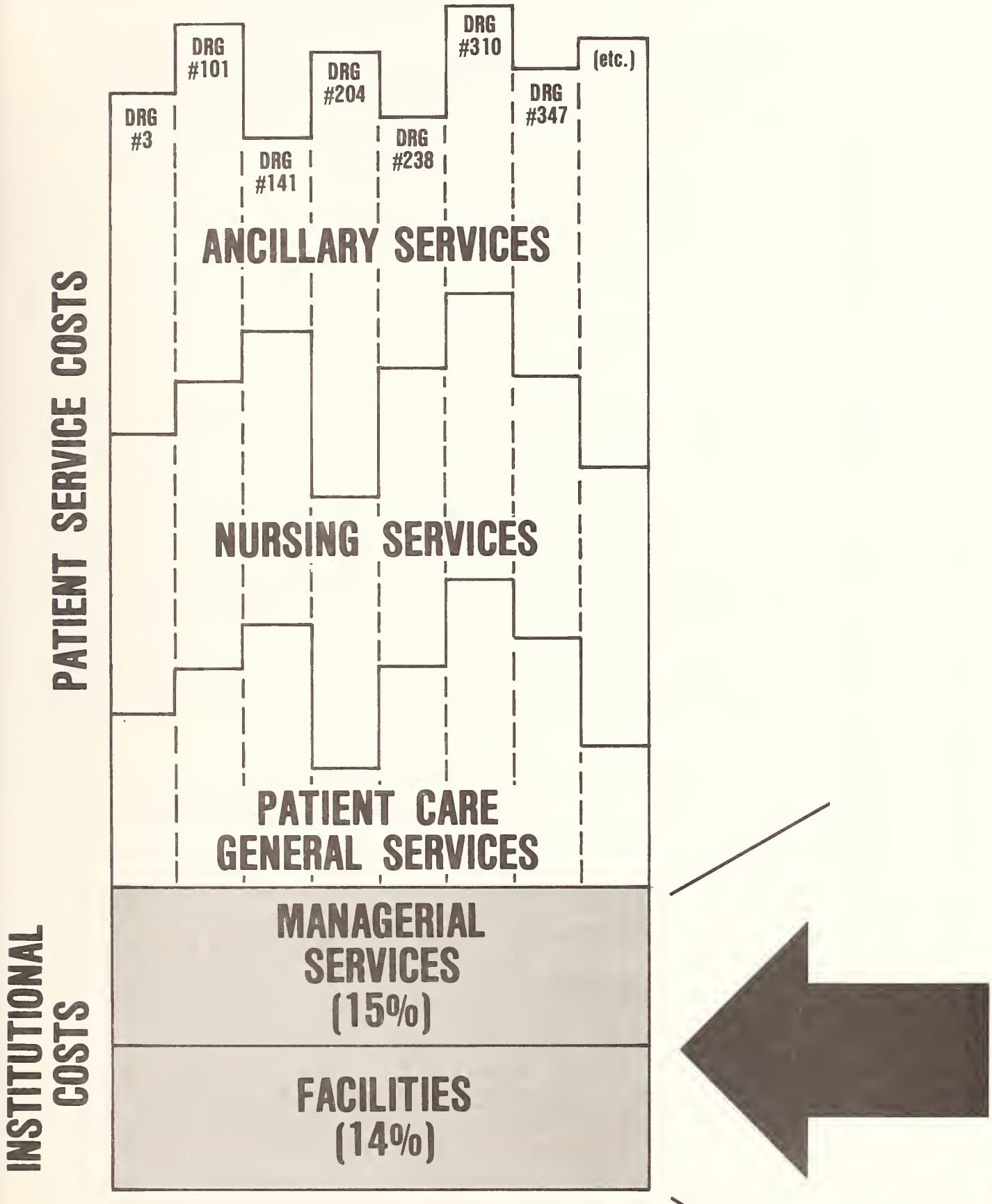
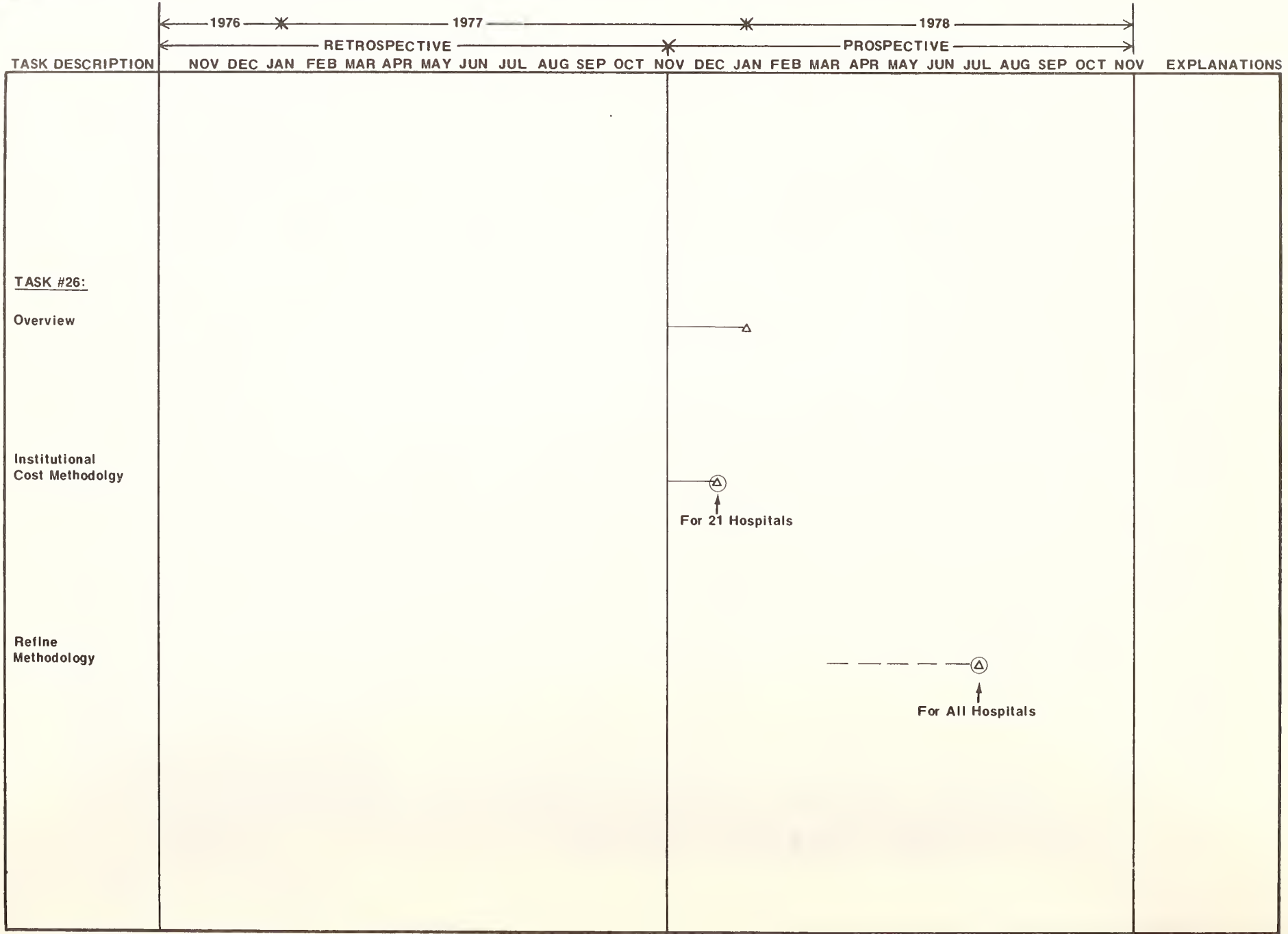


CHART 14:

Institutional Costs

TASK #26: Development of Non-DRG Related Reasonable Costs for Sample of Hospitals



4. Institutional Costs

The general service cost centers which remain represent the general management function and physicial facilities within which patient care services are provided:

Managerial Services

Administration and General
Fiscal
Malpractice Insurance
Other General Services

Physical facilities

Plant
Utilities

Leaving Malpractice Insurance aside, the remaining three Managerial Services cost centers each include a wide variety of services involved in operating a hospital. Administration and General includes such activities as administration, general insurance, communications, purchasing, chaplaincy, print shop, public relations, and receiving and storing. Fiscal includes comptrollership, accounting, admitting and outpatient registration, most data processing, payroll, and billing. Other General Services includes plant security, medical library, and motor pool. All of these diverse activities constitute the managerial support activities provided by the institution to patient care services. (Refer to Figure 17 for the percentage of total Institutional Costs and Chart 14 for the Task directly related to Institutional costs.)

The very act of separating patient care costs from other hospital costs will tend to, at the very least, sharpen and emphasize differences which may exist between institutions. As with the variation in patient care costs observed within DRG 242 (Section II.B), these institutional differences represent a point of departure for further inquiry: the process of explaining such differences will necessarily lead to a further refinement in either the methodology or a given hospital budget. Accordingly, with respect to the methodology, an effort to explain any dramatic differences in institutional costs will be made by testing more sensitive scaling techniques and alternative sets of characteristics for peer grouping through multivariate analysis. For peer comparison to be fair, it is essential that the methodology account for reasonable differences due to teaching status, size, location, etc. (For the impact of this on incentives, see Section II.C.2.)

For purposes of prospective budgeting, it is important that the methodology recognize that institutional costs are primarily fixed; that the demands on administrative, fiscal activities, etc., do not vary, at least in the short run, with admissions or patient days. Thus, if the peer grouping techniques are sufficiently sensitive, it should be possible to arrive at a fair global budget which accounts for the reasonable institutional costs of a hospital with certain characteristics. This budget base would be revised periodically to protect it against erosion by inflation. (See "Application of the Case-Mix Model," Section II.B.5.) Also, the payment process should help reinforce the process of prospective budgeting: the use of Periodic Intermittment Payment (PIP), rather than the per diem, should help to make income more predictable, stabilize cash flow and improve prospective budgeting; it may also help to remove any immediate incentive to prolong lengths of stay.

The physical facilities portion of institutional costs deserves special mention because it helps to illustrate an area of hospital cost where policy considerations eclipse methodology. As noted in the First Quarter Report: Volume II, Appendix B, efforts to revise Elements of Cost have paralleled the development of the case-mix reimbursement methodology. Treatment of the physical facilities element has revolved around the possible substitution of a form of capital facilities allowance for depreciation and the development of a mechanism for transferring limited capital resources to where they are needed most. On this matter, materials considered at the October 20, 1977 meeting of the Commissioner's Advisory Task Force on Elements of Cost appear in Appendix II.C.5.

5. Application of the Case-Mix Model

In the preceding sections we have discussed the various data sets required for input into the model: medical abstract data, functionally grouped cost data, and statistical Measures of Resource Use for each patient, or DRG, which provides a link between the first two data sets. These numbers constitute the raw material which is processed to arrive at a DRG cost, the direct expenses for patient care services provided with a hospital. The model groups these costs by DRG for each hospital and across hospitals. As noted, the term "DRG costs" represents only the direct expenses costs of ancillary services, nursing and patient care general services; institutional or "overhead" costs are treated separately as discussed in Section II.B.4.

Eight procedures are followed to arrive at costs per DRG:

a. Input Raw Data: Costs and Statistics

Functionally grouped hospital service costs from New Jersey's Standard Hospital Accounting and Rate Evaluation System (SHARE) are reported annually on a statewide uniform basis, with Actual costs submitted in May for the preceding year's expenses. The cost information is transcribed from the appropriate SHARE reporting forms and reorganized into a format amenable to the Case-Mix Model. (Input forms for this information is contained in Appendix I.B.1., "Cost Amounts.") A detailed list of those cost centers to be related to DRGs is provided by Table 2 on page 34. The costs reported within each cost center are organized into the following categories:

1. Physician salaries
2. Physician fees
3. Employee salaries
4. Depreciation, interest, and lease expenses (where reported)
5. Supplies and other expenses
6. Expense recoveries

b. Labor Cost Equalization

In order to compare hospital labor costs across hospitals in a state as diverse as New Jersey, the effects of geographic wage differentials are controlled for by a process referred to as "equalization." Ratios among three geographic regions (Northern, Other Metropolitan and Rural) are developed for average labor costs within the following six typologies:

- Administration and clerical employee salaries
- General service employee salaries
- Nursing and ancillary employee salaries
- Physician coverage compensation
- Residents salaries
- Education and research physician compensation

The appropriate regional ratios are then applied to the actual labor costs of each of the above typologies for each hospital.

c. Applying Factors for Fringe Benefits

Fringe benefit costs are reported in three SHARE cost centers (Legal Fringe Benefits, Policy Fringe Benefits, and Pensions). To these direct fringes are added imputed costs for subsidized employee meals and hospital self-insurance coverage for its employees. Total fringes are apportioned among all cost centers by each center's proportion of total salaries. These costs are identified separately from direct costs throughout the methodology. For some purposes (e.g., reimbursement) these costs may be displayed as part of the DRG related costs by cost center, but for other purposes (e.g., developing a hospital's budget by cost center), may be separated from direct salaries.

d. Separation of Inpatient and Outpatient Costs

Because DRGs reflect only inpatient activity, the costs of patient care services delivered to outpatients must be separated from the model. This is accomplished by means of applying an inpatient ratio to the total costs of each cost center. (See Appendix I.B.1, "New Jersey Inpatient Ratios.") Like Medicare's cost finding, the inpatient ratios for ancillary services are ratios of inpatient revenues of total revenues by cost center. For other centers, direct costing or an appropriate statistic is utilized for this separation. A distinction is drawn in the model between Covered Inpatient Costs (covered by New Jersey Blue Cross) and Inpatient Costs. Patient Services not included in the basic contract between New Jersey hospitals and Blue Cross are included in the Case-Mix Model (i.e., Therapeutic Radiology, Nuclear Medicine, and pacemakers) and allocated to DRGs, but can be removed from the DRG costs for reimbursement purposes.

e. Input Raw Data: Statistics

Three of the DRG-related cost centers (Central and Sterile Supply, Laundry and Linen, and Housekeeping) provide services to other cost centers; therefore, their costs can only be related to patients equitably based upon the patients' utilization of those other cost centers. For example, Housekeeping is provided to virtually all areas of the hospital; hence, a patients's consumption of Housekeeping resources depends upon the patient's utilization of each area of the hospital and the amount of Housekeeping provided to each area. Statistics to identify the costs of these three centers provided to these areas are drawn from Medicare's SSA-2552 Worksheet B-1 for each hospital. (See Appendix I.B.1., "New Jersey Statistics.") As with costs, these statistics are apportioned between in- and outpatient services.

f. Initial Allocation of Costs

The costs of the three centers listed above in step (e) are stepped down to the centers which they service by means of Medicare statistics through a process which is equivalent to an infinite step-down. (i.e., Services provided by the three centers to each other are accounted for before their costs are spread to other services.) Unlike most step-down techniques, however, the identity of these three centers is preserved and their costs are not treated as indirect costs of benefitting centers. Laundry and Linen and Central and Sterile Supply services provided to patient care units are categorized into acute care, intensive care, and newborn nursery in order to more accurately account for patient consumption of these resources.

g. Input: Medical Abstract Information and Measures of Resource Use

Patient medical abstracts from the hospitals are merged with patient billing information through a patient linking number, and arrayed by DRG in a common format as outlined in Section 5, "Medical Abstracts." Measures of Resource Use which are DRG specific rather than patient specific, such as nursing or dietary weights, are then assigned to each patient record based on the patient's DRG classification.

h. Allocation of Costs to DRGs

The equalized, fringed inpatient costs of each of the 24 cost centers to be DRG related are apportioned to each patient and/or DRG based on their percent consumption of the appropriate Measure of Resource Use by each patient and/or DRG. (See Table 2 for a listing of these cost centers and their respective Measures of Resource Use.) Thus, if Radiology charges for DRG #213 were 0.68% of the total charges to inpatients across all DRGs in Radiology, 0.68% of the inpatient costs of Radiology are apportioned to DRG #213. Summing across all 24 cost centers, a total cost per patient and/or DRG is derived. Average costs and their dispersion around the mean per DRG can thus be derived for each hospital or across hospitals. An illustration of this allocation process appears below.

COST FOR DRG #347
(Fracture of femur or pelvis with open reduction)

$$\frac{\text{reported charges for Patient in DRG \#347 in Radiology}}{\text{Total reported charges in Radiology}} \times \text{Equalized inpatient costs of Radiology}$$

+

$$\frac{\text{reported charges for patient in DRG \#347 in Laboratory}}{\text{total reported charges for laboratory}} \times \text{Equalized inpatient costs of Laboratory}$$

+

$$\frac{\text{reported charges for patient in DRG \#347 in Central and Sterile Supply}}{\text{Total reported charges in Central and Sterile Supply}} \times \text{Equalized inpatient costs of Central and Sterile Supply}$$

+

$$\frac{\text{reported charges of patient in DRG \#347 in Operating and Recovery Rooms}}{\text{Total reported charges in Operating and Recovery Rooms}} \times \text{Equalized inpatient costs of Operating and Recovery Rooms}$$

+

$$\frac{\text{reported charges of patient in DRG \#347 in Physical Therapy}}{\text{total reported charges in Physical Therapy}} \times \text{Equalized inpatient costs of Physical Therapy}$$

and so forth, including the allocation of Nursing and Patient Care General Service costs;

summed for all admissions to DRG #347

As will be discussed in the section entitled "Health Care Economics: Cost-Based versus Incentive Reimbursement," the reimbursement rate for individual DRGs or groups of DRGs, adjusted as appropriate, will be developed using corridors. (See Section II.C.2.) In order to construct a prospective budget for each hospital, costs must be unequalized and an economic factor applied to protect the rate from inflationary erosion. (See Third Quarter Report: Volume I, pp. 116-119 concerning the economic factor. The selection of appropriate proxy measures is now undergoing final review.)

6. Preliminary Results

As noted in the very beginning of this section, trial run results for four institutions were presented to the Health Care Administration Board on September 20, 1977. While the cautions noted should be respected and no final conclusions drawn, the results were encouraging. The distributions of patients by total DRG costs were well defined, especially so for DRGs with large numbers of cases. Figure 18 presents a histogram of DRG costs for DRG 159, hypertrophy of tonsils and adenoids (T and A). There were 1,156 patients in this DRG in the four hospitals combined, with an average patient care service cost of $286 and a standard deviation of $56. The cost histogram shown in Figure 18 reveals a tight distribution in which 85.2% of patients had costs within the range of $200-$350. Figure 18a shows that the tight distribution of costs across hospitals is preserved when examined by hospital, in spite of the higher cost displayed by Hospital D whose median cost was at the 75th percentile across all hosptals combined. Results for the next seven most popular DRGs in the trial run hospitals are shown on pages 72a-p.

The results of the trial run demonstrate that patient care service costs (excludes institutional costs) per diem is not a valid measure of cost performance. Figures 21-21a presents for DRG 124, ischemic heart disease except acute myocardial infarction without surgery and with a major secondary diagnosis, a distribution of costs in an identical format to Figures 18-18a. Table 12 shows average costs per case and per diem, and average length of stay for this DRG for the four trial run hospitals individually.

Although Hospital A's case cost was $715 and Hospital's C's case cost was $997, cost per day in Hospital A was actually higher than that in Hospital C, $91 to $78 because of a respective length of stay differential of 7.9 days in Hospital A compared with 12.8 days on Hospital C. In fact, Hospital A so consistently out performed Hospital C in terms of cost that for 353 out of the 383 DRGs (92 percent), Hospital A had a lower average cost per case than Hospital C. However, per diem costs across all patients for the two hospitals were practically identical, $82 for Hospital A and $84 for Hospital C.

Finally, the preliminary results revealed a wide variation of average case costs across DRGs. Table 13 presents six common DRGs and their unit costs, average length of stays, costs per day, number of patients, and English descriptions. A patient in DRG 197 (pediatric hernia) cost an average of $254 whereas a patient in DRG 11 (gastrointestinal cancer with major surgery) cost an average of $2855. Cost per day varied substantially also: $82 per day for DRG 158 to $220 per day for DRG 159.

FIGURE 18: Histogram of DRG 159

DRG No. 159

Distribution of Costs Across Patients for All Trial Run Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
1156	$330911	$286.25	$56.49

HYPERTROPHY OF TONSIL & ADENOID

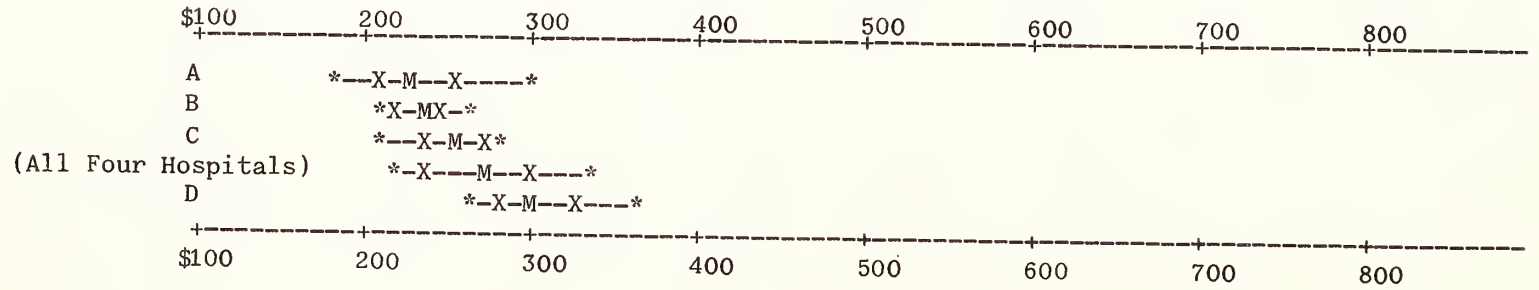
VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
0- 49	0	.0%	.0%	
50- 99	0	.0%	.0%	
100- 149	10	.9%	.9%	*
150- 199	27	2.3%	3.2%	****
200- 249	279	24.1%	27.3%	**
250- 299	398	34.4%	61.8%	**
300- 349	309	26.7%	88.5%	***
350- 399	97	8.4%	96.9%	***************
400- 449	30	2.6%	99.5%	*****
450- 499	4	.3%	99.8%	
500- 549	0	.0%	99.8%	
550- 599	2	.2%	100.0%	

FIGURE 18a: Histogram of DRG 159

DRG No. 159

Distribution of Costs Across Patients by Hospital

HYPERTROPHY OF TONSIL & ADENOID



PATIENT DISTRIBUTION

Legend: First * = 10th percentile
First X = 25th percentile
M = median
Second X = 75th percentile
Second * = 90th percentile

	NO. OF PATIENTS	MEAN CASE COST	STANDARD DEVIATION
A	212	$240.91	$53.47
B	117	242.72	17.14
C	251	261.53	32.52
(All Four Hospitals)	1156	286.26	56.41
D	576	322.60	45.66

FIGURE 19:

Histogram of DRG 318

DRG No. 318

Distribution of Costs Across Patients for All Trial Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
4258	$983054	$230.87	$50.40

NORMAL MATURE BORN

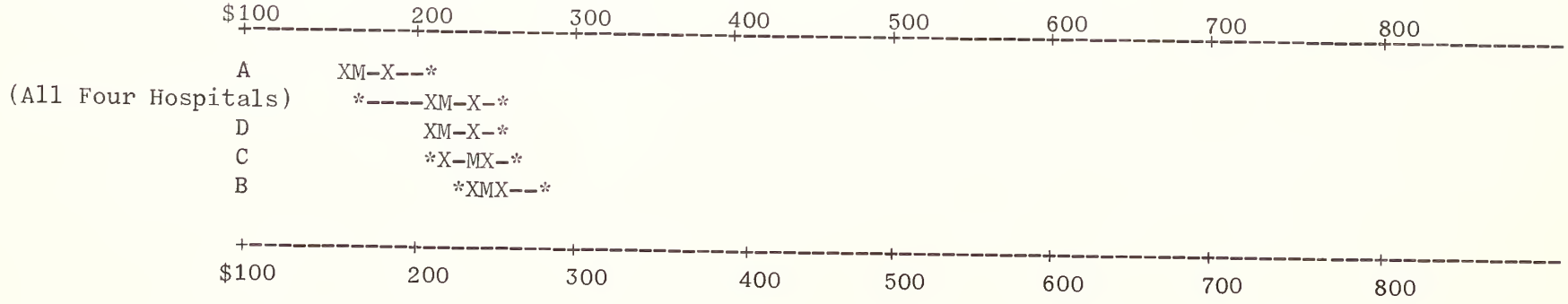
VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
0- 49	0	.0%	.0%	
50- 99	0	.0%	.0%	
100- 149	6	.1%	.1%	
150- 199	798	18.7%	18.9%	**********
200- 249	2438	57.3%	76.1%	**********
250- 299	839	19.7%	95.8%	**********
300- 349	79	1.9%	97.7%	***
350- 399	32	.8%	98.4%	*
400- 449	29	.7%	99.1%	*
450- 499	17	.4%	99.5%	
500- 549	6	.1%	99.7%	
550- 599	5	.1%	99.8%	
600- 649	6	.1%	99.9%	
650- 699	3	.1%	100.0%	

FIGURE 19a:
Histogram of DRG 318

DRG No. 318

Distribution of Costs Across Patients by Hospital

NORMAL MATURE BORN



PATIENT DISTRIBUTION

Legend:
First * = 10th percentile
First X = 25th percentile
M = median
Second X = 75th percentile
Second * = 90th percentile

	NO. OF PATIENTS	MEAN CASE COST	STANDARD DEVIATION
A	936	$179.46	$43.35
(All Four Hospitals)	4258	230.87	50.32
D	1389	240.86	51.19
C	1527	245.22	32.97
B	406	261.32	32.27

FIGURE 20:
Histogram of DRG 281

DRG No. 281

Distribution of Costs Across Patients for All Trial Run Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
979	$471864	$481.99	$107.54

DELIVERY WITH COMPLICATION WITHOUT OPERATION OR
WITH OPERATION ASSISTING DELIVERY

VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS
200- 249	13	1.3%	1.3% **
250- 299	41	4.2%	5.5% ********
300- 349	19	1.9%	7.5% ***
350- 399	47	4.8%	12.3% *********
400- 449	204	20.8%	33.1% **********
450- 499	291	29.7%	62.8% **********
500- 549	185	18.9%	81.7% **********
550- 599	91	9.3%	91.0% **********
600- 649	45	4.6%	95.6% *********
650- 699	19	1.9%	97.5% ***
700- 749	10	1.0%	98.6% **
750- 799	1	.1%	98.7%
800- 849	5	.5%	99.2% *
850- 899	2	.2%	99.4%
900- 949	2	.2%	99.6%
950- 999	1	.1%	99.7%
1000- 1049	1	.1%	99.8%
1050- 1099	1	.1%	99.9%

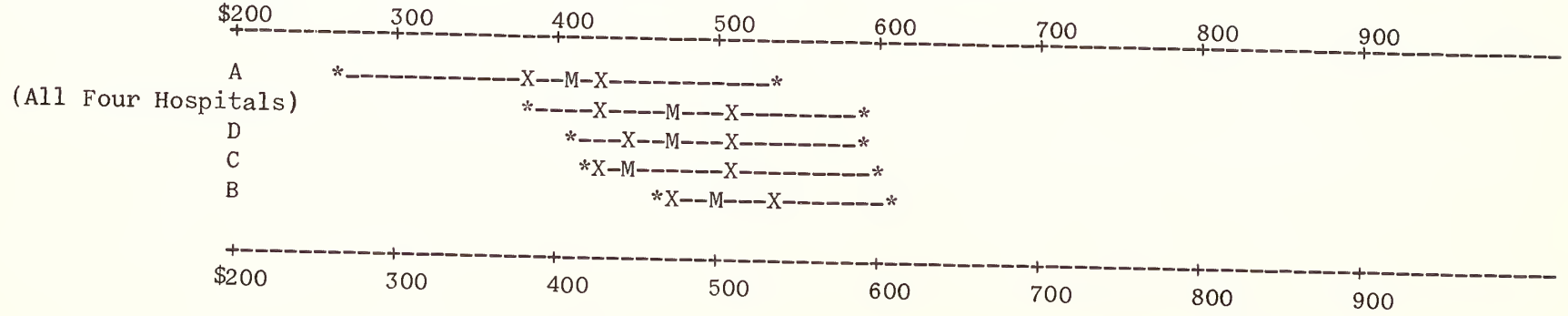
FIGURE 20a:

Histogram of DRG 281

DRG No. 281

Distribution of Costs Across Patients by Hospital

DELIVERY WITH COMPLICATION WITHOUT OPERATION OR
WITH OPERATION ASSISTING DELIVERY



PATIENT DISTRIBUTION

Legend:
- First * = 10th percentile
- First X = 25th percentile
- M = median
- Second X = 75th percentile
- Second * = 90th percentile

	NO. OF PATIENTS	MEAN CASE COST	STANDARD DEVIATION
A	170	$415.67	$109.67
(All Four Hospitals)	979	481.99	107.45
D	467	486.56	106.34
C	171	488.42	102.00
B	171	529.07	78.52

DRG No. 124

ISCHEMIC HEART DISEASE EXCEPT
ACUTE MYOCARDIAL INFRACTION WITHOUT OPERATION WITH MAJOR SECONDARY DIAGNOSIS

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
950	$912263	$960.28	$286.91

VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
500- 549	11	1.2%	1.2%	**
550- 599	26	2.7%	3.9%	*****
600- 649	41	4.3%	8.2%	********
650- 699	47	4.9%	13.2%	*********
700- 749	66	6.9%	20.1%	**********
750- 799	97	10.2%	30.3%	**********
800- 849	87	9.2%	39.5%	**********
850- 899	89	9.4%	48.8%	**********
900- 949	87	9.2%	58.0%	**********
950- 999	76	8.0%	66.0%	**********
1000- 1049	52	5.5%	71.5%	**********
1050- 1099	56	5.9%	77.4%	**********
1100- 1149	34	3.6%	80.9%	*******
1150- 1199	23	2.4%	83.4%	****
1200- 1249	40	4.2%	87.6%	********
1250- 1299	28	2.9%	90.5%	*****
1300- 1349	16	1.7%	92.2%	***
1350- 1399	18	1.9%	94.1%	***
1400- 1449	7	.7%	94.8%	*
1450- 1499	14	1.5%	96.3%	**
1500- 1549	3	.3%	96.6%	
1550- 1599	1	.1%	96.7%	
1600- 1649	4	.4%	97.2%	
1650- 1699	5	.5%	97.7%	*
1700- 1749	3	.3%	98.0%	
1750- 1799	2	.2%	98.2%	
1800- 1849	2	.2%	98.4%	

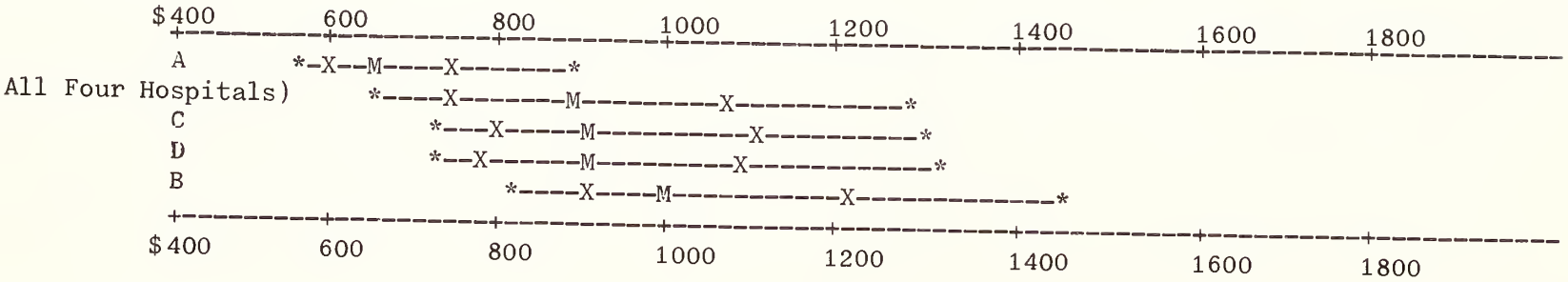
FIGURE 21: Histogram of DRG 124

FIGURE 21a:
Histogram of DRG 124

DRG No. 124

Distribution of Costs Across Patients by Hospital

ISCHEMIC HEART DISEASE EXCEPT
ACUTE MYOCARDIAL INFRACTION WITHOUT OPERATION WITH MAJOR SECONDARY DIAGNOSIS



PATIENT DISTRIBUTION

Legend:
First * = 10th percentile
First X = 25th percentile
M = median
Second X = 75th percentile
Second * = 90th percentile

	NO. OF PATIENTS	MEAN CASE COST	STANDARD DEVIATION
A	175	$715.41	$141.84
(All Four Hospitals)	950	960.28	286.96
C	374	996.49	269.73
D	281	1002.07	290.19
B	120	1106.68	285.71

FIGURE 22:
Histogram of DRG 381

DRG No. 381

Distribution of Costs Across Patients for All Trial Run Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
922	$312633	$339.08	$78.63

SPECIAL ADMISSION WITH OPERATION ON
STERILIZATION OR DILATATION & CURETTAGE

VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
0- 49	0	.0%	.0%	
50- 99	0	.0%	.0%	
100- 149	1	.1%	.1%	
150- 199	5	.5%	.7%	*
200- 249	25	2.7%	3.4%	*****
250- 299	225	24.4%	27.8%	**********
300- 349	323	35.0%	62.8%	**********
350- 399	246	26.7%	89.5%	**********
400- 449	66	7.2%	96.6%	**********
450- 499	18	2.0%	98.6%	***
500- 549	6	.7%	99.2%	*
550- 599	1	.1%	99.3%	
600- 649	3	.3%	99.7%	

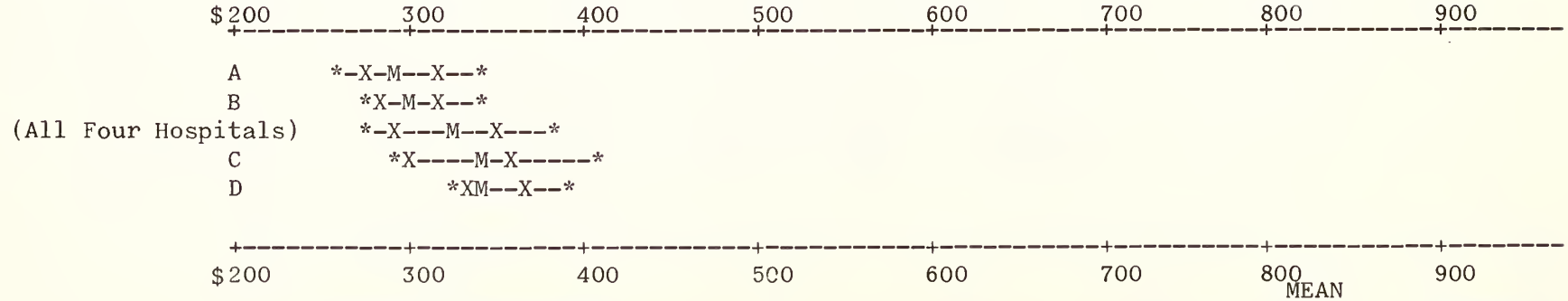
FIGURE 22a:

Histogram of DRG 381

DRG No. 381

Distribution of Costs Across Patients by Hospital

SPECIAL ADMISSION WITH OPERATION FOR
STERILIZATION OR DILATATION & CURETTAGE



PATIENT DISTRIBUTION

Legend:
- First * = 10th percentile
- First X = 25th percentile
- M = median
- Second X = 75th percentile
- Second * = 90th percentile

	NO. OF PATIENTS	MEAN CASE COST	STANDARD DEVIATION
A	216	$301.89	$43.99
B	229	316.99	94.07
(All Four Hospitals)	922	339.08	78.56
C	145	352.15	61.01
D	332	372.86	75.48

FIGURE 23: Histogram of DRG 121

Distribution of Costs Across Patients for All Trial Run Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
864	$1196074	$1384.34	$471.01

ACUTE MYOCARDIAL INFARCTION

VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
700- 749	3	.3%	.3%	
750- 799	9	1.0%	1.4%	**
800- 849	19	2.2%	3.6%	****
850- 899	16	1.9%	5.4%	***
900- 949	24	2.8%	8.2%	*****
950- 999	40	4.6%	12.8%	*********
1000- 1049	34	3.9%	16.8%	*******
1050- 1099	58	6.7%	23.5%	************
1100- 1149	64	7.4%	30.9%	**************
1150- 1199	60	6.9%	37.8%	************
1200- 1249	59	6.8%	44.7%	************
1250- 1299	70	8.1%	52.8%	*****************
1300- 1349	58	6.7%	59.5%	************
1350- 1399	47	5.4%	64.9%	**********
1400- 1449	41	4.7%	69.7%	*********
1450- 1499	35	4.1%	73.7%	********
1500- 1549	24	2.8%	76.5%	*****
1550- 1599	23	2.7%	79.2%	*****
1600- 1649	23	2.7%	81.8%	*****
1650- 1699	14	1.6%	83.4%	***
1700- 1749	17	2.0%	85.4%	***
1750- 1799	17	2.0%	87.4%	***
1800- 1849	12	1.4%	88.8%	**
1850- 1899	18	2.1%	90.9%	****
1900- 1949	8	.9%	91.8%	*
1950- 1999	11	1.3%	93.1%	**
2000- 2049	8	.9%	94.0%	*
2050- 2099	5	.6%	94.6%	*
2100- 2149	5	.6%	95.1%	*
2150- 2199	6	.7%	95.8%	*
2200- 2249	4	.5%	96.3%	
2250- 2299	3	.3%	96.6%	

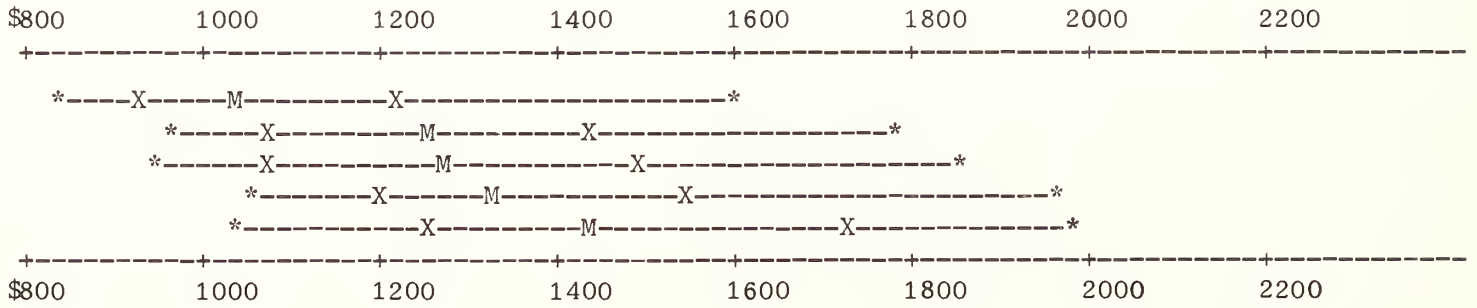
FIGURE 23a:

Histogram of DRG 121

DRG No. 121

Distribution of Costs Across Patients by Hospital

ACUTE MYOCARDIAL INFARCTION



PATIENT DISTRIBUTION

Legend:
- First * = 10th percentile
- First X = 25th percentile
- M = median
- Second X = 75th percentile
- Second * = 90th percentile

	NO. OF PATIENTS	MEAN CASE COST	STANDARD DEVIATION
A	178	$1198.54	$482.11
C	336	1349.45	413.64
(All Four Hospitals)	864	1384.37	470.88
D	179	1484.43	517.69
B	171	1541.84	433.67

FIGURE 24: Histogram of DRG 249

DRG No. 249

Distribution of Costs Across Patients for All Trial Run Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
750	$390582	$520.78	$179.03

DISEASE OF BLADDER & URETHRA WITH
CYSTOSCOPY, EXCISION, DILATION, REPAIR OF AGE GREATER THAN 14

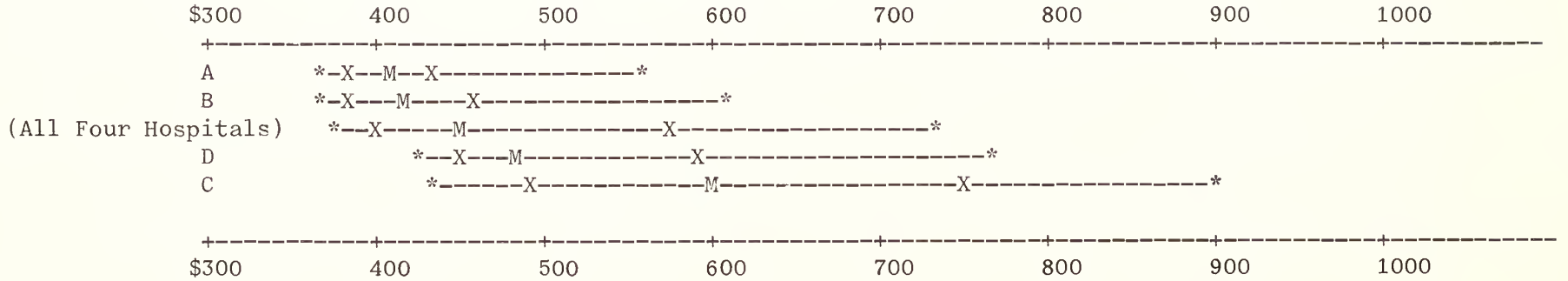
VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
250- 299	1	.1%	.1%	
300- 349	16	2.1%	2.3%	****
350- 399	129	17.2%	19.5%	**********
400- 449	190	25.3%	44.8%	**********
450- 499	121	16.1%	60.9%	**********
500- 549	78	10.4%	71.3%	**********
550- 599	60	8.0%	79.3%	**********
600- 649	34	4.5%	83.9%	********
650- 699	30	4.0%	87.9%	*******
700- 749	22	2.9%	90.8%	****
750- 799	22	2.9%	93.7%	****
800- 849	6	.8%	94.5%	*
850- 899	10	1.3%	95.9%	**
900- 949	5	.7%	96.5%	*
950- 999	7	.9%	97.5%	*
1000- 1049	3	.4%	97.9%	
1050- 1099	5	.7%	98.5%	*
1100- 1149	4	.5%	99.1%	*
1150- 1199	0	.0%	99.1%	
1200- 1249	2	.3%	99.3%	
1250- 1299	0	.0%	99.3%	
1300- 1349	1	.1%	99.5%	
1350- 1399	0	.0%	99.5%	
1400- 1449	0	.0%	99.5%	
1450- 1499	2	.3%	99.7%	

FIGURE 24a: Histogram of DRG 249

DRG No. 249

Distribution of Costs Across Patients by Hospital

DISEASE OF BLADDER & URETHRA WITH
CYSTOSCOPY, EXCISION, DILATION, REPAIR OF AGE GREATER THAN 14



PATIENT DISTRIBUTION

Legend:
- First * = 10th percentile
- First X = 25th percentile
- M = median
- Second X = 75th percentile
- Second * = 90th percentile

	NO. OF PATIENTS	MEAN CASE COST	STANDARD DEVIATION
A	263	$441.58	$105.45
B	120	466.47	149.87
(All Four Hospitals)	750	520.78	178.97
D	247	565.95	185.50
C	120	655.78	208.37

DRG No. 4

FIGURE 25: Histogram of DRG 4

Distribution of Costs Across Patients for All Trial Run Hospitals

NUMBER OF PATIENTS	TOTAL COST	MEAN CASE COST	STANDARD DEVIATION COST
677	$341088	$503.82	$288.02

VENEREAL DISEASE, VIRAL ORIGIN DISEASE
(ASEPTIC MENINGITIS, WART, OTHER) WITH SECONDARY DIAGNOSIS

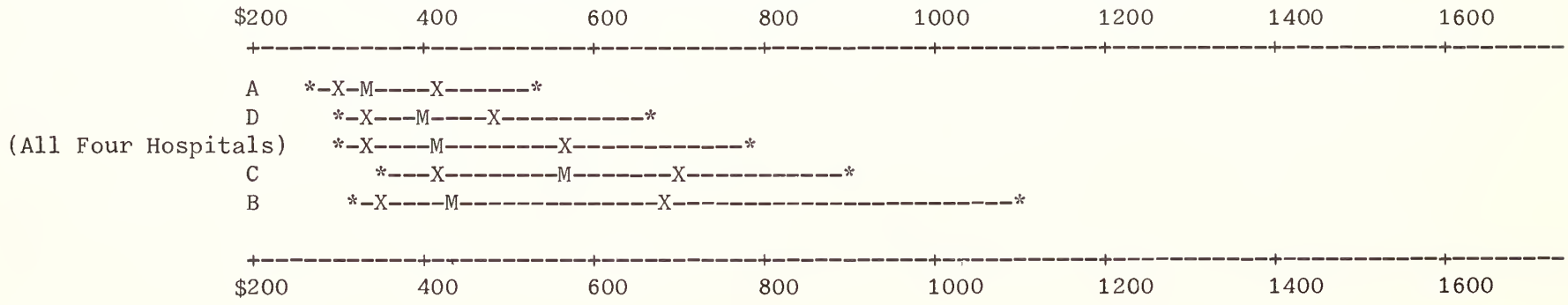
VALUE IN DOLLARS	NUMBER OF PATIENTS	PERCENT OF PATIENTS	CUMULATIVE PERCENT OF PATIENTS	
150- 199	1	.1%	.1%	
200- 249	7	1.0%	1.2%	**
250- 299	46	6.8%	8.0%	**********
300- 349	111	16.4%	24.4%	**********
350- 399	134	19.8%	44.2%	**********
400- 449	80	11.8%	56.0%	**********
450- 499	57	8.4%	64.4%	**********
500- 549	48	7.1%	71.5%	**********
550- 599	39	5.8%	77.3%	**********
600- 649	37	5.5%	82.7%	**********
650- 699	22	3.2%	86.0%	******
700- 749	22	3.2%	89.2%	******
750- 799	14	2.1%	91.3%	****
800- 849	11	1.6%	92.9%	***
850- 899	8	1.2%	94.1%	**
900- 949	9	1.3%	95.4%	**
950- 999	2	.3%	95.7%	
1000- 1049	5	.7%	96.5%	*
1050- 1099	3	.4%	96.9%	
1100- 1149	3	.4%	97.3%	
1150- 1199	1	.1%	97.5%	
1200- 1249	4	.6%	98.1%	
1250- 1299	1	.1%	98.2%	
1300- 1349	3	.4%	98.7%	
1350- 1399	2	.3%	99.0%	
1400- 1449	0	.0%	99.0%	
1450- 1499	2	.3%	99.3%	
1500- 1549	2	.3%	99.6%	

FIGURE 25a: Histogram of DRG 4

DRG No. 4

Distribution of Costs Across Patients by Hospital

VENEREAL DISEASE, VIRAL ORIGIN DISEASE
(ASEPTIC MENINGITIS, WART, OTHER) WITH SECONDARY DIAGNOSIS



PATIENT DISTRIBUTION

Legend:
First * = 10th percentile
First X = 25th percentile
M = median
Second X = 75th percentile
Second * = 90th percentile

	NO. OF PATIENTS	MEAN CASE COST	STANDARD DEVIATION
A	220	$402.75	$187.29
D	162	464.33	212.01
(All Four Hospitals)	677	503.83	287.98
C	234	595.21	219.19
B	61	622.85	634.88

TABLE 12:

Cost Per Case and Per Diem by Hospital: DRG 124
ISCHEMIC HEART DISEASE EXCEPT ACUTE MYOCARDIAL INFARCTION WITHOUT OPERATION WITH MAJOR SECONDARY DIAGNOSIS

HOSPITAL	PATIENTS	UNIT COST	AVG LOS	COST PER DAY
A	175	$ 715	7.9	$ 91
B	120	1107	11.1	100
C	374	997	12.8	78
D	281	1002	8.5	118

TABLE 13:

Cost Per Case and Per Diem, Selected DRGs

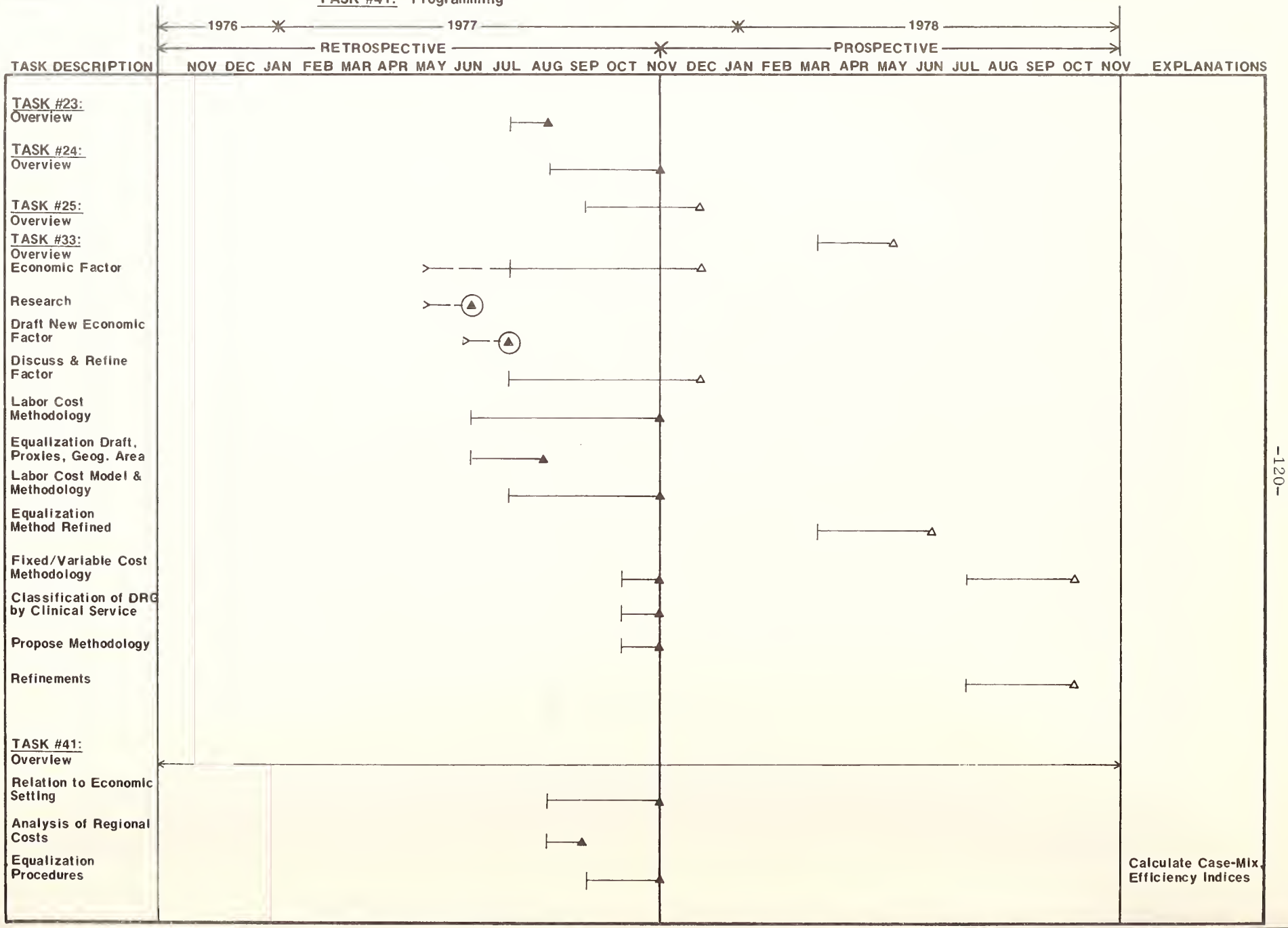
DRG	UNIT COST	AVG LOS	COST PER DAY	# OF PATIENTS	ENGLISH DESCRIPTIONS
197	$254	2.3	$110	296	Abdominal Hernia of Age < 15
159	286	1.3	220	1156	Hypertrophy of Tonsil and Adenoid
158	484	5.9	82	428	Hemorrhoids
227	831	10.0	83	305	Disease of Gall Bladder and Bile Duct with Operation without Secondary Diagnosis
121	1384	16.3	85	864	Acute Myocardial Infarction
11	2855	24.2	118	295	Cancer of GI System with exploratory Laparotomy, Resection of Intestine, or Other Major Operation

Should similar data for all New Jersey hospitals show substantial ranges in case costs and per diem costs, it may be concluded that a hospital's costs are heavily dependent upon its mix of patients as opposed to merely its number of patient days. Refer to Chart 15 for those Tasks which contribute to the economic setting of New Jersey hospitals.

CHART 15:

Economic Setting of N.J. Hospitals

TASK #23: Allocate Equalized Costs to DRG for Sample of Hospitals
TASK #24: Review and Analysis of Costs per DRG for Sample of Hospitals
TASK #25: Development of Methodology for Reasonable Cost Screens
TASK #33: Allocate Equalized Cost to DRG for All Hospitals for Quarter's Data
TASK #41: Programming



SECTION II

C. Application of Diagnosis Related Groups (DRGs)

1. Quality

2. Health Care Economics:

   Cost-Based vs. Incentive Reimbursement

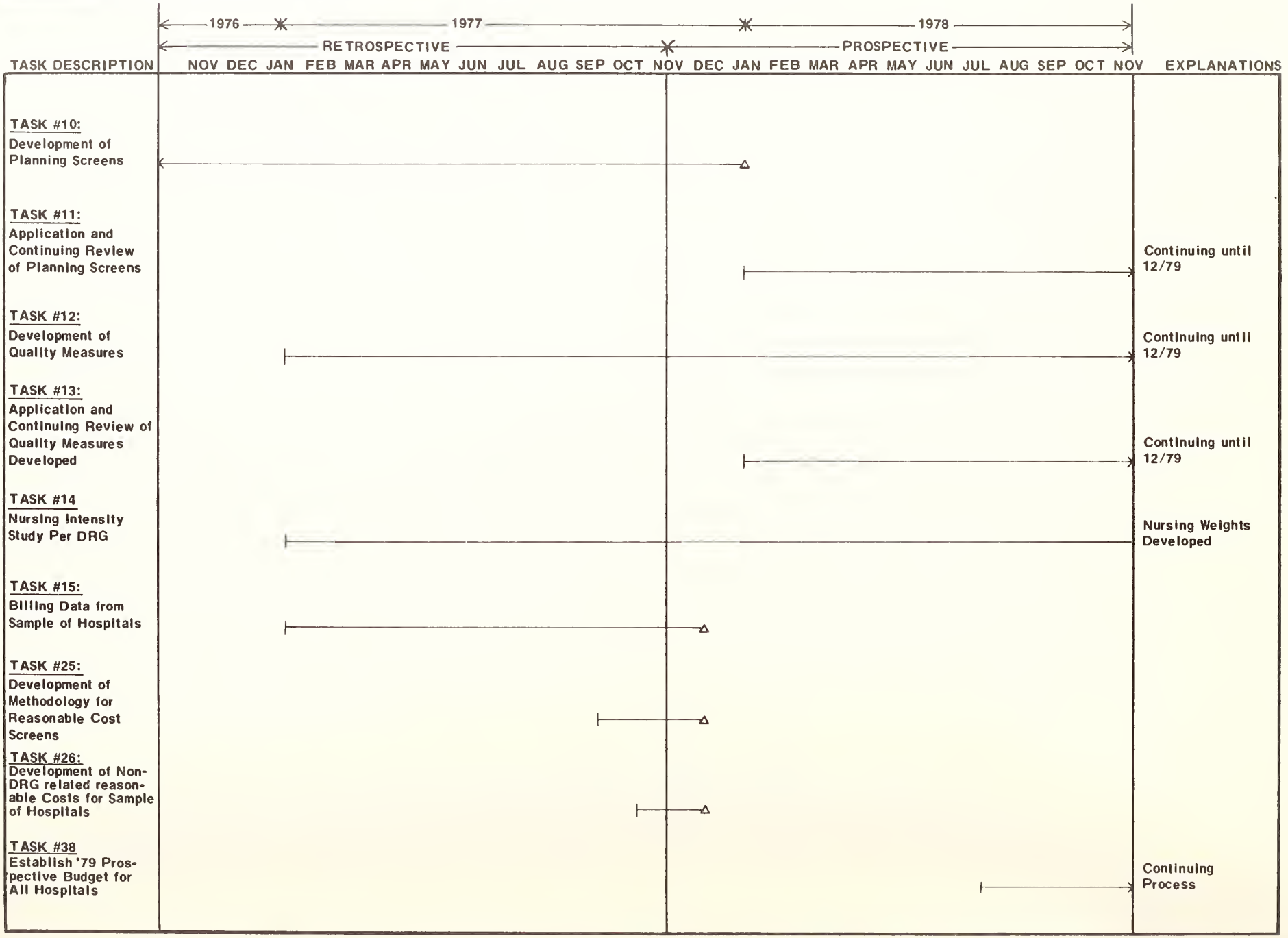
3. Accessibility

4. Implementation

CHART 16:

Introduction: Case-Mix And Hospital Services

Case-Mix And Hospital Services:
Towards A Patient Care System for New Jersey


1976
1977
1978
RETROSPECTIVE
PROSPECTIVE
TASK DESCRIPTION
NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV
EXPLANATIONS
TASK #10:
Development of Planning Screens
TASK #11:
Application and Continuing Review of Planning Screens
Continuing until 12/79
TASK #12:
Development of Quality Measures
Continuing until 12/79
TASK #13:
Application and Continuing Review of Quality Measures Developed
Continuing until 12/79
TASK #14
Nursing Intensity Study Per DRG
Nursing Weights Developed
TASK #15:
Billing Data from Sample of Hospitals
TASK #25:
Development of Methodology for Reasonable Cost Screens
TASK #26:
Development of Non-DRG related reasonable Costs for Sample of Hospitals
TASK #38
Establish '79 Prospective Budget for All Hospitals
Continuing Process

C. Application of Diagnosis Related Groups (DRGs) to Planning

The two preceding sections illustrated how a framework for the analysis of current hospital management and care practices is provided by relating financial and medical data bases on an unprecedented scope for a state hospital regulatory system. Because of the sensitivity of the resource consumption typologies provided by the DRGs and the Case-Mix Model New Jersey has at its disposal the fundamental data by which to relate hospital resources to total inpatient care needs.

This match of resources and needs must have an empirical basis which accounts for the following basic dimensions of a health care delivery system:

1. quality of patient care
2. health care economics
3. accessibility of patient care

In accordance with health planning goals, efforts must be directed toward optimally balancing the quality, costs, and accessibility of the health care delivery system.

For the first time, a state is designing a rate-setting and reimbursement system which attempts to address the complex relationships between costs and quality of patient care. Furthermore, the linking of medical and financial data bases allows the State to join its regulatory powers for rate-setting with health care planning (i.e., state health plans, certificate of need, licensing and standards). For example, by examining the utilization of certain inpatient services using the case-mix methodology, the relationship between medical quality and utilization may be ascertained. Volume and intensity changes in patient care services (variations in case-mix) will create differential demands on a hospital's infra-structure (managerial services and physical facilities), and in the long run, will modify its institutional costs. Therefore, the rate-setting mechanism, now able to identify the costs of treating any given sub-population of patients, may be utilized to establish and enforce empirical utilization levels commensurate with quality considerations. (Refer to Chart 16 for those Tasks associated with Planning.)

Health care planning may be described conceptually according to at least two mutually inclusive typologies:

1. Time-interval planning

   - short-term planning
   - intermediate planning
   - long-term or "meta-planning"

2. Goal-directed planning

   - institutional planning
   - program planning
   - regional planning

Regarding time-interval planning, short-term planning is defined as a review of specific projects (i.e., certificate of need) in order to implement an intermediate plan. Intermediate planning is defined as the identification of specific activities to be undertaken within a limited period of time in order to implement a long-term plan, and is presented in terms of an array of alternatives with recognized economic impacts (e.g., HSA planning for regionalization of certain kinds of tertiary care). Long-term planning is defined as an examination of the overall demand for health care services with the provision for appropriate changes in that system over time (i.e., HSA or state plan). Because long-term planning often involves the "process of planning about planning," it may also be referred to as meta-planning.

With regard to goal-directed planning, institutional planning may be defined as the establishment of goals and objectives by a health care facility directed towards the overall mission of the facility and not confined to any particular set of services offered (e.g., a hospital's capital budgetary process). Program planning is defined as the establishment of goals and objectives to address any given subset of the health care system which cuts across institutional lines, but does not address the totality of the services provided by any given facility. (Regional Medical Programs which planned for the treatment and referral of stroke patients is an example of program planning.) Regional planning is defined as the establishment of goals and objectives for meeting the health care needs of a population within a given geographical area (e.g., Health Services Areas or a given state's territory).

Time-interval planning and goal-directed planning should intersect along a rational continuum (Institutions should address immediate goals such as the coming year's operating budget; and regions should be concerned with meta-planning for aligning institutional and program planning to a long-term statewide master plan.) However, planners are often concerned with the approval of current certificates of need without regard for their impacts on neighboring institutions and facilities.

As noted in the previous section, the data organized by the DRG system of classification can be shaped to meet the needs of regulators and hospital financial management. Likewise, it can be shaped in different ways to meet the needs of planners and the medical profession, the parties whose tasks are discussed in the sections which follow. The whole point of view of the system can be altered to help focus more clearly on matters other than reimbursement, such as quality, accessibility and optimal resource allocation. Of great significance is the fact that since the same building blocks are used, DRGs can serve as a common denominator and medium through which various parties with diverse interests can commence a meaningful dialogue.

The following narrative is divided into four sections designated as "Quality," "Health Care Economics," "Accessibility," and "Implementation." The first three sections are devoted to discussions of concepts and of how the proposed system can impact upon the quality, economics, and accessibility of patient care in order to more fully systematize the relationships of these dimensions for New Jersey hospitals. The fourth section, "Implementation," proposes a number of pragmatic and policy-related means for moving towards a more optimal allocation of hospital care resources for the public at large.

The reader should note that as opposed to the preceding two sections ("Introduction to Diagnosis Related Groups" and "Costs per Diagnosis Related Groups") which approach methodological soundness, this section represents the Project's primary developmental activities for the coming year in anticipation of implementation.

1. Quality

The problem of defining and specifying the attributes of quality has confronted medical theoreticians and practitioners for years. Because the concept of quality is so amorphous and controversial, theoreticians have been forced to a large extent to define quality in the negative, that is, the absence of some service or condition. This approach to defining quality follows the same logic which is employed in forming the operational definition of health as the absence of disease. Irrespective of the semantic and conceptual problems, the attainment of quality patient care is the focus of medical art and science, and must be the ultimate purpose of any health care delivery system. (Refer to Charts 17 and 18 for Tasks directly related to Planning.)

Among the more commonly accepted attributes of quality are the following:

- quantity of care
- types of care to treat various diseases
- process of delivering care
- types of providers
- provider behavior
- timeliness and appropriateness of care
- outcome (effect upon the patient's condition or well-being)

The problem of measuring the universe of attributes of quality has been reduced by Donabedian[15] into his now classic thesis which views quality in the light of the following three components of measurement:

(1) Structure - the organization of the health care delivery system or sub-system within which patient care is delivered.

(2) Process - the means and manner by which care is delivered.

(3) Outcome - the effect, if any, upon the patient's illness, condition or state of health which is attributable to the delivery of care.

In an endeavor to address the measurement of quality for a prospective reimbursement system based on patient case-mix, a number of data bases corresponding to Donabedian's components defined above are available to the Project. The structure within which medical care occurs, the hospital setting, may be

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15. Avedis Donabedian, "The Evaluation of Medical Care Programs," Bulletin of the New York Academy of Medicine, XLIV (February,1968), pp. 118-122.

CHART 17:

TASK #12: Development of Quality Measures
TASK #13: Application and Continuing Review of Quality Measures Developed

Quality

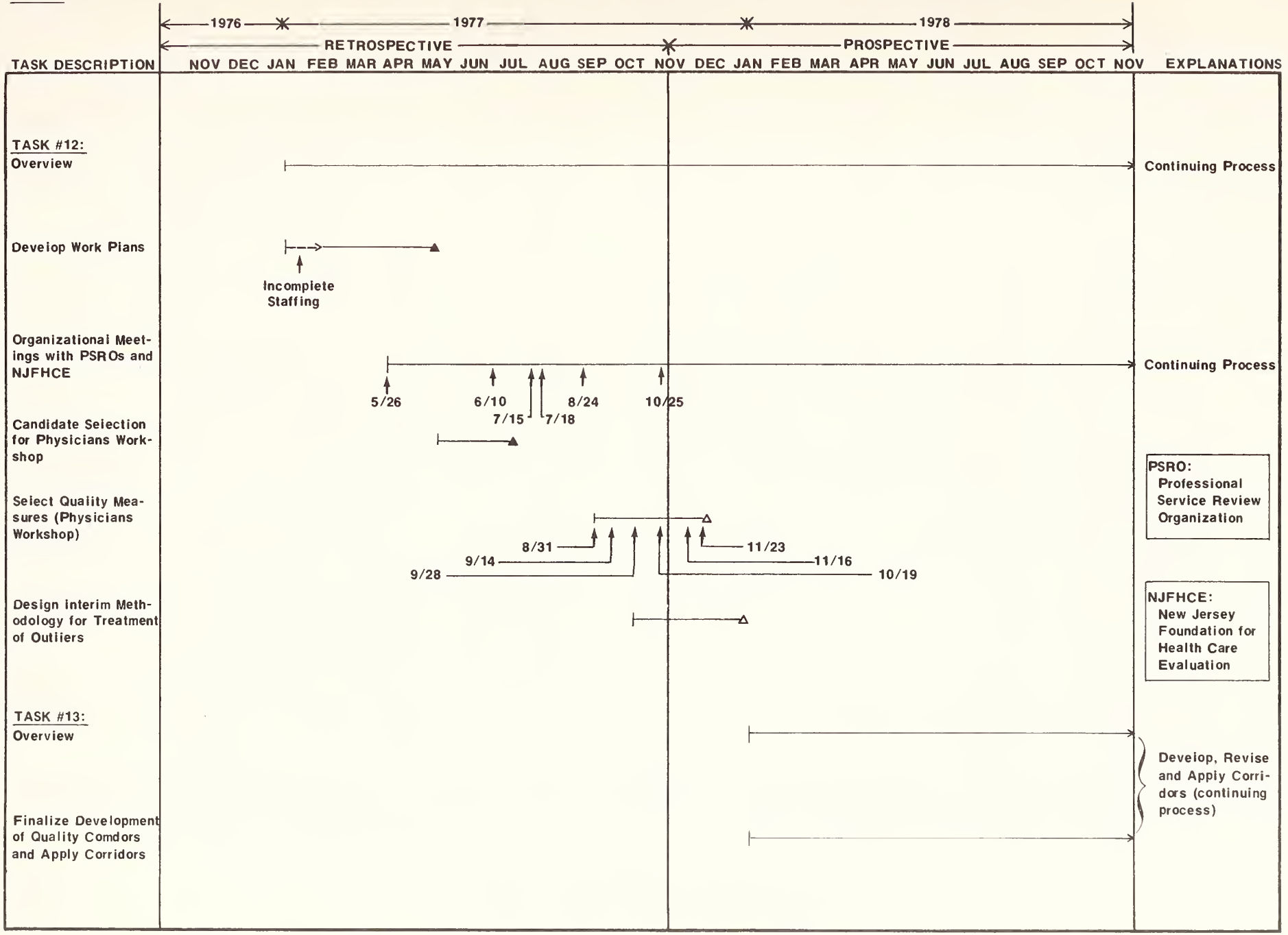
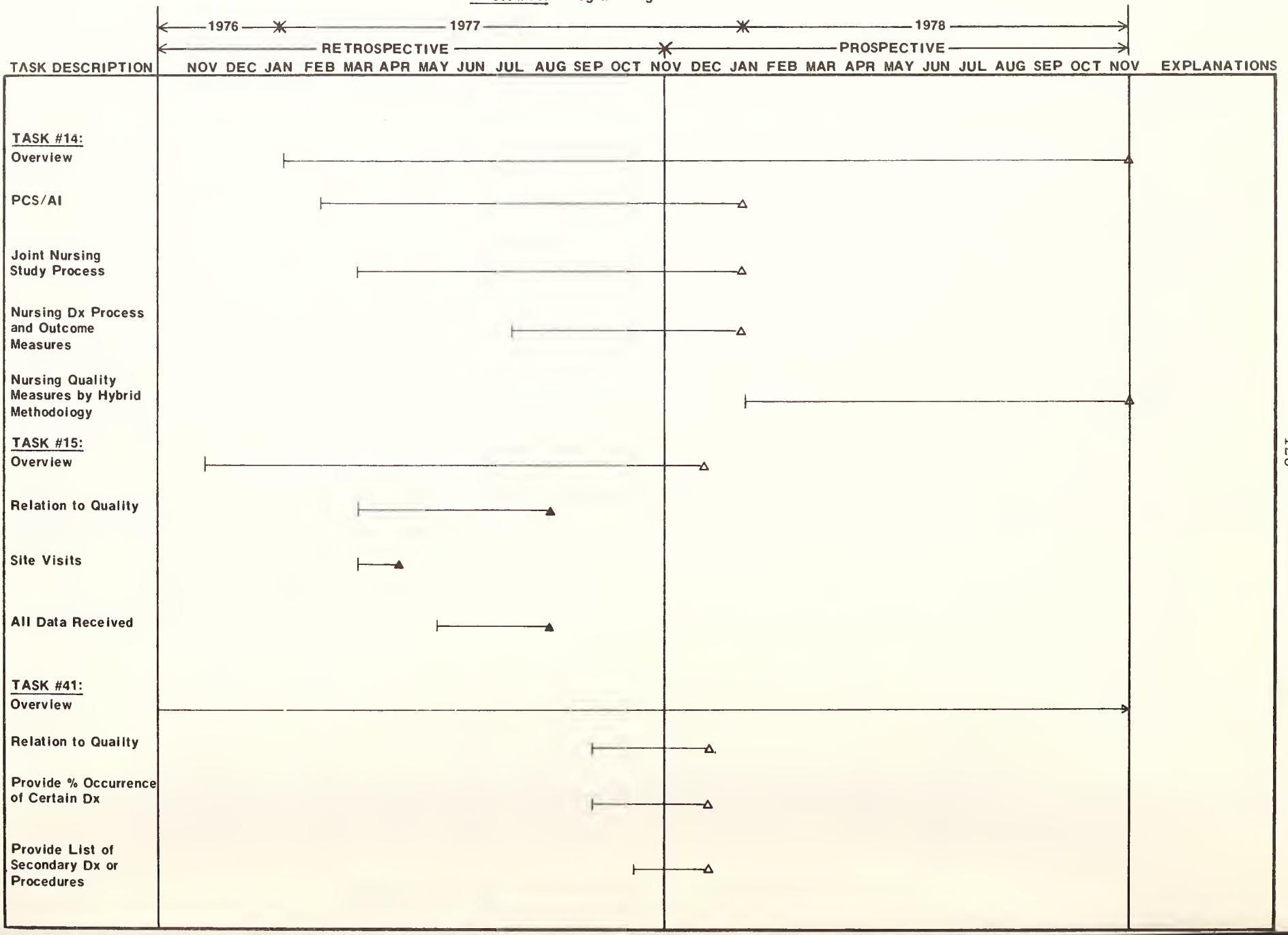


CHART 18:

Quality

TASK #14: Nursing Intensity Study Per DRG
TASK #15: Billing Data from Sample of Hospitals
TASK #41: Programming



measured by the vast assortment of institutional characteristics and cost data available to the Department of Health primarily through the SHARE system. Indicators of process may be culled from medical discharge abstracts, billing data, and data from the Project's three Nursing Study Pilot Studies. Indicators of outcome may be selected from medical discharge abstracts and the results of the Project's Nursing Diagnosis Pilot Study.

The general methodology which will be outlined in the following narrative is developmental in nature, and will not be available for linking quality indicators with 1978 case-mix reimbursement rates for the hospitals participating in New Jersey Experiment II.

Utilizing the case-mix approach and input from the PSROs in helping to specify the quality, necessity, and appropriateness of medical care, indicators of process and outcome have been developed. The extrapolation may be made that certain hospital structural characteristics are associated with the process and outcome of patient care (e.g., DRG-specific mortality rates related to volume of treatment and/or teaching status). By means of reimbursement, certificate of need, and licensing and standards, the State may, together with the PSROs, HSAs and others, modify the allocation of resources in order to provide for a more optimal distribution of resources in New Jersey's hospital care delivery system.

a. DRG-Specific Quality Measures

While DRGs have been discussed throughout this report as a means for explaining variance in hospital inpatient resource consumption, perhaps one of the most important advantages of such a system is that it provides a sampling framework for medical information in which to view the quality issue.

At the present time, the Commissioner's Physician Advisory Committee for Quality Development (For a detailed account of the purpose and evolution of this interdisciplinary group of medical experts, see Second Quarter Report: Volume I, pp. 38-40; Third Quarter Report: Volume I, pp. 62-67; and Appendices I.C.1.) is involved in the identification of medical process and outcome indicators from hospital discharge abstracts. The ultimate goal of this endeavor is to design a reimbursement system which considers such parameters as mortality rates, prevalence of aberrant diagnoses and procedures, and over-and under-utilization of services as quality components in developing a statistical corridor for setting rates.

Since the first meeting of the Commissioner's Physician Advisory Committee (See Appendix I.C.2 for minutes of the workshops and products generated.), a number of recommendations for process and outcome indicators have been made. For example, the group proposed the following set of indicators and criteria in considering a quality screen for DRGs 225-228, diseases of the gallbladder and bile duct, with and without surgery:

(1) Admission Criteria

a. evidence of common duct stones and biliary tract disease

b. X-ray evidence of tract disease

(2) Work-up

a. history and physical to sort out icteric and non-jaundiced cases

b. rectal exam in males

c. rectal and pelvic exam in females

d. PAP in all females of childbearing age or over

e. pregnancy test for all females of childbearing age or over (The group decided that pregnancy tests are indicated in all childbearing age females before any abdominal surgery. The group also wishes to discuss further methods for assessing evidence of too much breast or abdominal irradiation in childbearing age females.)

(3) Lab

a. CBC

b. urinalysis

c. SMSA-12 (minimum multichannel)

d. chest X-ray

e. prothrombin time

(4) Procedures

a. electrocardiogram

b. upper GI series

c. oral cholecystogram

(5) Special Lab/Procedures (If primary diagnosis is gallbladder disease and secondary diagnosis is jaundice.)

a. If serum bilirubin is less than 3, patients should have an IV cholangiogram.

b. Patients with jaundice and obstructive disease should have a percutaneous trans-hepatic cholangiogram, liver scan and SGOT.

(6) Survival

a. Pediatric group should have a mortality rate no greater than 1.0 percent.

b. Geriatric group should have a mortality rate no greater than 5.0 percent.

(7) Discharge Status

a. There should be no evidence of jaundice.

b. disappearance of jaundice in previously icteric patients

(8) Outcome (Incidence rates will be determined and empirically validated by computer at the last workshop.)

a. low incidence of post-operative infection

b. low incidence or absence of retained stones

c. wound dehiscence less than 0.5 percent

d. low incidence or absence of cardiopulmonary emboli

e. minimal pneumonia especially with acute gall-bladder disease

f. post-operative bleeding less than 1.0 percent

g. absence of anesthesia complications such as aspiration pneumonia and atalectsis

As quality parameters such as those given above are recommended by the group, the Project will study the cost and computer feasibility of the parameters, especially if not currently available on discharge abstracts. The group's final recommendations need to be based upon a balance between good quality indicators and feasibility for entering these in the data base. This trade-off will be addressed with the participation of the New Jersey Medical Records Association and the PSROs.

The PSRO - Department of Health Liaison Committee has continued to meet during the year. The Committee is presently pursuing the feasibility of a shared data base. If this proves possible, substantial cost savings should result.

The following four divergent areas within the two existing data bases have been identified.

(1) Coverage — The PSRO data base covers Title 18, Title 19, and Title 5 patients; the Department of Health receives and needs medical record abstracts for all patients.

(2) Physician identifiers — PSROs must have Physician Identifiers; the Department has promulgated a regulation which prohibits it from receiving this information.

(3) Frequency of tape submittal — The PSROs are presently receiving tapes on a monthly basis; the Department receives tapes quarterly.

(4) PSRO Specific Data Requirements — PSROs require specific data elements for concurrent reviews on Title 18 and 19 patients; this data is not needed by the Department.

Project staff is presently examining these divergences, and the Department will attempt to resolve these issues with the PSROs. Once the problems of physician confidentiality, data submission timing, and data accuracy requirements are resolved, a determination will be made as to where the data is to be stored and how it is to be processed and distributed. In addition, once a common data set has been developed, it may be shared by other interested users such as the HSAs, hospitals, Blue Cross, Medicaid, etc.

As part of the development of quality screens, the data base now available to the Department may be used to test some of the indicators, and to address specific questions raised by the physicians (e.g., mortality rates). There have been three general types of computer programs generated to explore recommended quality indicators.

The first type of quality-related program (Appendix I.C.3) provides a count of the number of hospitals whose percentage of occurrence of a certain diagnosis or procedure falls within a given range. For example, one suggested quality parameter was the occurrence of hysterectomy in women under thirty for DRG #59 (benign neoplasm of uterous (fibroma) or ovary with hysterectomy (abdominal or vaginal)). Appendix I.C.3 shows the output from the program relative to this screen. By referring to this output, the Advisory Committee can decide whether or not to use this criterion in establishing a screen. (For example, a 2% occurrence of hysterectomy in this age group might constitute an acceptable level for a hospital.)

The second type of quality-related computer program is similar to the first. However, instead of occurrences of specified diagnoses or procedures, the output documents mortality rates for each DRG.

The third type of quality-related program can list all secondary diagnoses or all procedures for a specified DRG. The need for this type of program arose from a discussion of DRGs 225 and 226 (diseases of gallbladder and bile duct without operation). The discussion centered around why a gallbladder and bile duct problem would ever be treated without surgical intervention. The group concluded that there may be secondary diagnoses precluding surgery. As a result, a list of all secondary diagnoses was produced to enable the physicians to decide the validity of a "no surgery" decision. The computer program for DRGs 225 and 226 was broken down by ten-year age intervals at the request of the Advisory Committee. Appendix I.C.4 shows a sample of the output for DRGs 225 and 226.

b. Patient-Specific Quality Measures

On a patient care level, the case-mix methodology identifies instances in which the medical care resources devoted to treating patients exceed medical practice norms controlling for types of diseases, operative procedures, and patient's age. Such aberrant cases are referred to as "outliers" and are described in detail in Section I. Not only may outliers be designated by the excessive consumption of bed-days, but they may also be identified by the Case-Mix Model which reveals cases where the consumption of patient care dollars is inordinately low when compared with statewide medical practice norms. Such cases may be suspect with regards to quality of patient care.

Outliers may also be attributable to sources other than differential practice such as medical abstract coding errors, the occurrence of atypical disease entities for which the patient population was insufficient for generating another DRG, and the lack of alternative systems of care to short-term

acute hospitalization (i.e., placement into Skilled Nursing Facilities (SNFs)). The case-mix methodology is especially amenable to the identification of the magnitude of needs for SNF beds. For instance, transfer rates to SNFs by DRG may be associated with regional SNF occupancy rates to assess the real need for additional SNF beds or the need for custodial care, given statewide medical referral standards.

The analysis of outliers may also serve to illustrate the necessity for case-by-case review on a more efficient problem identification basis than current PSRO practices.[16] The development of a prospective reimbursement system based on patient case-mix will require close interaction with PSROs. In a continuing effort to create such an important professional tie, the Department of Health has opened working channels with the PSROs and the New Jersey Foundation for Health Care Evaluation. (Refer to the Second and Third Quarter Reports.) As this close relationship is maintained, the identification of outliers may be built into the PSROs concurrent utilization review system and Medical Care Evaluation studies (MCEs) to augment the effectiveness of hospital quality of care and utilization review committees.

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16. PSRO review activities using the DRG approach are ongoing in the following areas:

    a. Bureau of Quality Assurance-for the design of a national PSRO reporting system
    b. Connecticut Area II PSRO
    c. Dade-Monroe PSRO, Inc.
    d. Colorado Foundation for Medical Care
    e. Wisconsin PSRO
    f. South Carolina Medical Care Foundation
    g. Central Massachusetts Health Care Foundation
    h. Multnomah Foundation for Medical Care

FIGURE 26: Incentive Reimbursement

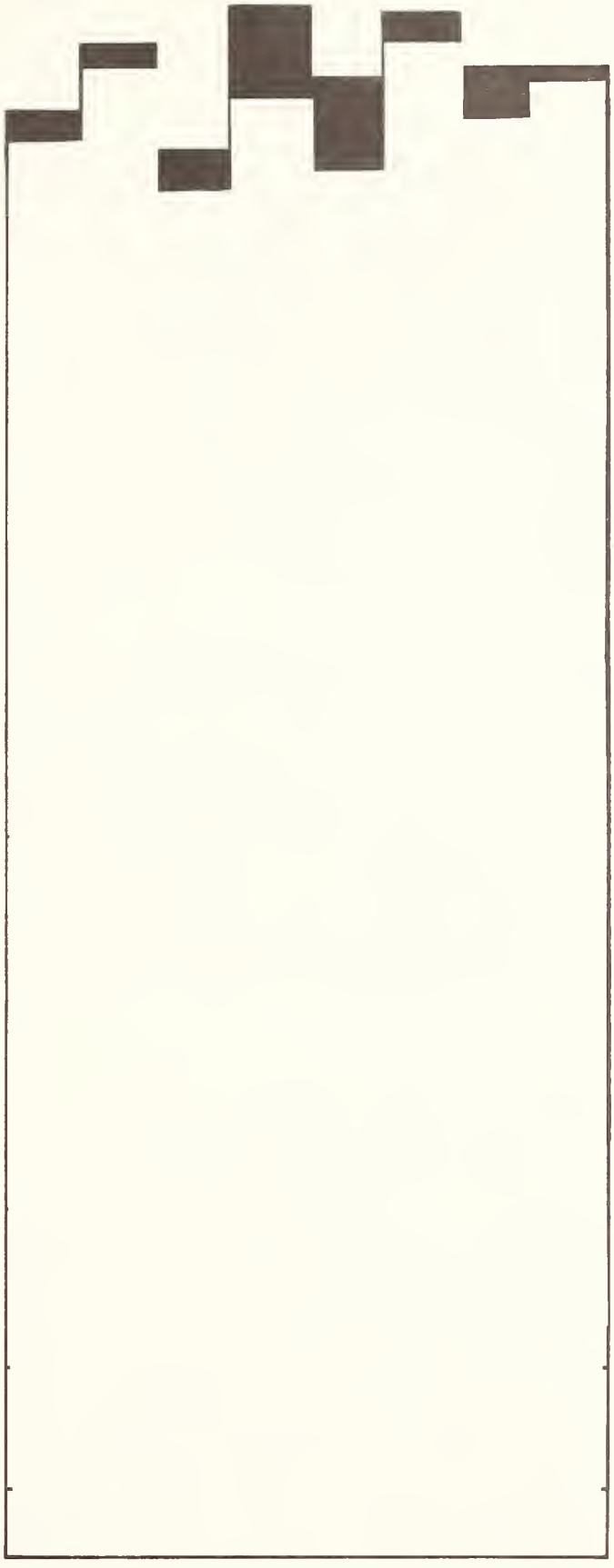
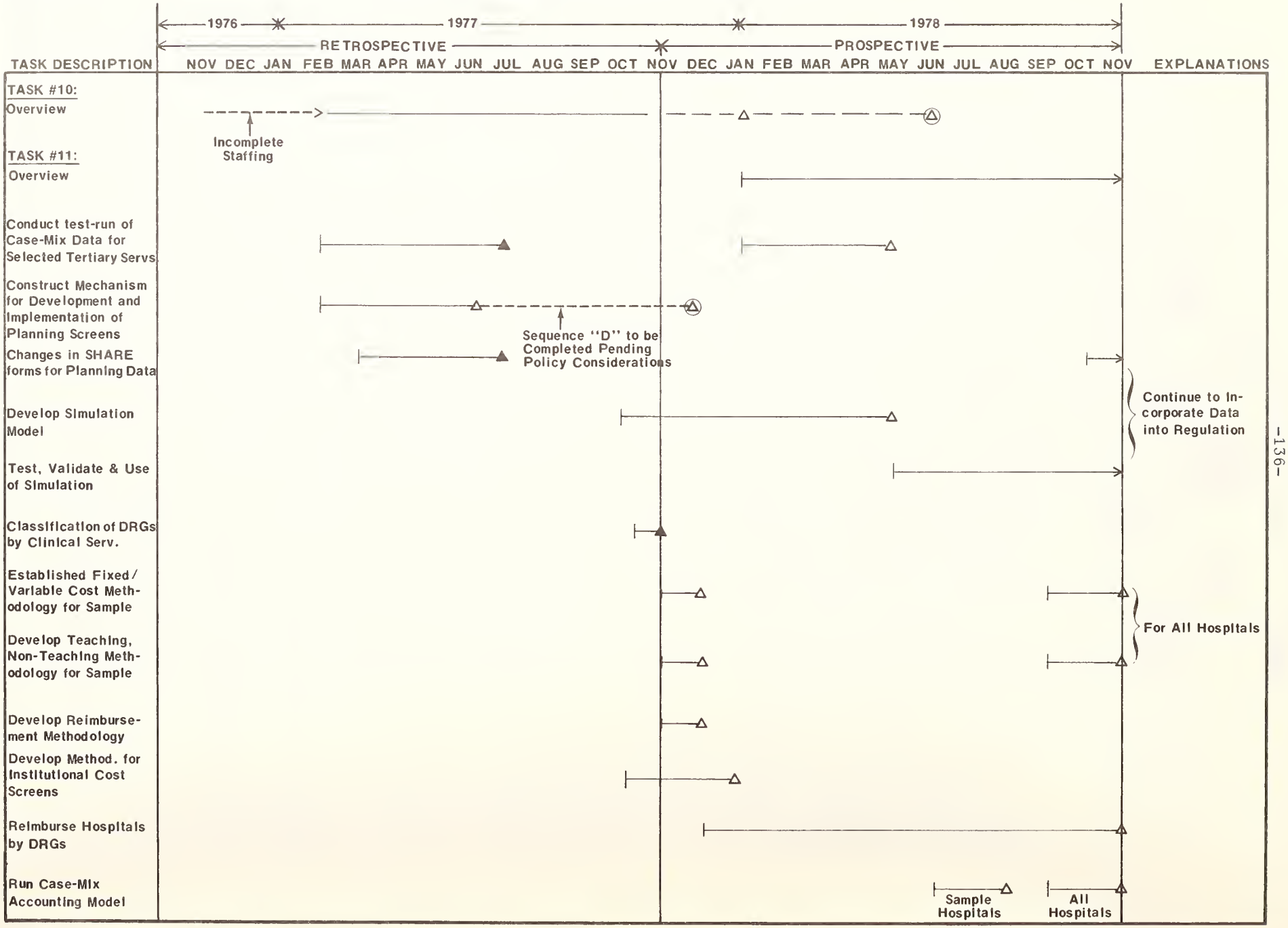


CHART 19:

Economics

TASK #10: Development of Planning Screens
TASK #11: Application and Continuing Review of Planning Screens


1976
1977
1978
RETROSPECTIVE
PROSPECTIVE
TASK DESCRIPTION
NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV
EXPLANATIONS
TASK #10:
Overview
Incomplete Staffing
TASK #11:
Overview
Conduct test-run of Case-Mix Data for Selected Tertiary Servs
Construct Mechanism for Development and Implementation of Planning Screens
Sequence "D" to be Completed Pending Policy Considerations
Changes in SHARE forms for Planning Data
Develop Simulation Model
Continue to Incorporate Data into Regulation
Test, Validate & Use of Simulation
Classification of DRGs by Clinical Serv.
Established Fixed/Variable Cost Methodology for Sample
Develop Teaching, Non-Teaching Methodology for Sample
For All Hospitals
Develop Reimbursement Methodology
Develop Method. for Institutional Cost Screens
Reimburse Hospitals by DRGs
Run Case-Mix Accounting Model
Sample Hospitals
All Hospitals

2. Health Care Economics: Cost-Based Versus Incentive Reimbursement

The health care delivery "system" lacks the essential elements of a market. Unlike automobiles or haircuts, the products or services are often demanded on a crisis basis, frequently under conditions which do not lend themselves to comparison shopping. Unlike sticks of butter, the cost of a given episode is likely to vary by multiples. (As noted previously, the patient care related cost to treat a patient in DRG 197 (pediatric hernia) averaged $254 whereas patients in DRG 11 (gastrointestinal cancer with major surgery) incurred average costs of $2855.) Consumers are generally unable to evaluate the quality of services received, and are usually informed or indifferent regarding the costs of services provided since these are largely reimbursed by third-party payors. Moreover, consumers are to a large degree unaware of the availability of comparable or alternative services. In fact, it has been contended that physicians act as both providers and consumers of health care services.

This absence of a market mechanism creates a situation which fails to encourage allocation of the limited resources available to the health care delivery system in an economically optimal manner. Regulatory authorities have traditionally filled this void with cost-based reimbursement, a methodology which tends to encourage hospital financial management to maximize reimbursement by constantly probing the system for imprecise cost definitions and loose screens, by adjusting projections and devising ever more creative explanations for additional costs. Unfortunately, the allocation of scarce health care dollars is too often a product of relative skill at this contest between the regulated and the regulator rather than any reasoned, comprehensive scheduling of priorities. (Refer to Chart 19 for those Tasks which contribute to Health Care Economics.)

DRGs represent a beginning point for the establishment of "prices" for various "products" provided by hospitals. This rather sensitive tool could be used to screen costs ever more closely, thus giving the regulator the upperhand. However, rather than carry this absurd reimbursement contest to its extreme, it was felt that the DRGs might equally provide an opportunity and a basis to actually harmonize the goals of the regulator and regulated; to finally bring together their energies over issues such as cost and quality in the public interest. Rather than the ultimate screening device, DRGs could provide the basis for establishing a kind of artificial market for hospital products. Coupled with a proper incentive, DRGs could finally provide a logical financial reason for hospital financial management to provide these products as efficiently and effectively as possible. (Figure 26)

a. Corridors

Corridors may be defined as some dispersion around an average or median cost. Corridors are currently used in peer grouping to allow for imprecision in measurement that results from the inexact fit of the methodology to the complex contours of the hospital reimbursement problem (e.g., individual institution case-mix). These corridors may represent penalties to some and, as noted above, opportunities for additional reimbursement to others. Corridors might be used, however, to help carry out policy: By "reversing the polarity" and using corridors to form appropriate incentives, as opposed to making regulatory room for unexplained costs, the interests of the regulated and the public might begin to converge.

The inspiration for connecting corridors to incentives comes from the first report of the Hearer, Honorable Sidney Goldmann (included in Appendix B-4 of the Third Quarter Report). In that report Judge Goldmann stated on p. 26:

> The 1% productivity factor inserted in a hospital rate is arbitrary, since it unfairly discriminates against hospitals already efficient and can only bear upon those that are inefficiently administered. The productivity factor should be variable.

By examining distributions of individual DRGs, groups of DRGs, DRGs grouped by hospital and by peer groups of hospitals, it is possible to identify likely areas of inefficiency within an individual institution. If developed properly, a system sufficiently flexible to permit the calculation of an individual productivity goal by hospital may be possible and should provide the basis for fair and appropriate reimbursement treatment of those institutions which are already efficient and those which must become so.

Incentives can be structured in many ways. With respect to the Experiment hospitals, institutions which choose the DRG rate are entitled to keep "half the difference" should their actual costs come in under their prospective DRG rate. Thus, if the rate for DRG "x" were established at $800 and the institution's actual cost to treat DRG "x" was $700, it would receive $750. From many points of view, including the ease with which the public, as well as the hospital might relate to this goal, there is virtue in simplicity.

The commitment by this Department to giving incentive reimbursement a fair trial comes from the belief that the practical steps required to actually realize efficiency savings must be taken at the institutional level. Thus, in the Third Quarter Report on p. 12, the State outlined one example where an operational efficiency which crosses and affects numberous DRGs is identified: an excessive pre-operative length of stay resulting from an inability to "turn around" lab tests. The variety of outside contractual arrangements of staffing patterns or equipment which might solve this problem, thus reducing the need for nursing, dietary services, etc., is a matter best considered by hospital management. Similarly, if pulmonary DRGs are grouped and reveal a pattern of cost consistently in excess of the statwide numbers, this information provides the opportunity for an extremely important dialogue among relevant participants. A common denominator gives parties of diverse backgrounds, (financial and medical), a device by which to intelligently raise and discuss these differences.

Obviously, there are many ways to set up an incentive so that sensitive judgments such as those described above produce a net benefit to the institution. For example, the Project staff has considered a form of "progressive" incentive which would establish norms that differ from the simple "splitting the difference." Under this concept, once having entered the corridor, a hospital would receive an increasing proportion of the incentive as it moves toward the desired efficiency norm.

The kinds of considerations which go into the development of an incentive depend on the different shapes of the cost distributions which appear around the various DRGs. These distributions reflect, in essence, the "votes" of hospital management concerning the proper allocation of resources. As indicated in the Third Quarter Report: Volume I:

> Charges, of course, are also RVUs, except that they are in fact -- or ought to be -- the Relative Value Unit of a given procedure which is assigned by hospital fiscal administration; it can and should reflect their studied judgment, a broader perspective concerning not only cost or degree of difficulty to the radiologist, but the relative value of a given input required by a given DRG as weighed against and compared with other resources which may be substituted.

The collection of charge data, nursing RIMs, and patient care related general service weights reflects the DRG philosophy: As illustrated by the simple equation originally set forth in the Third Quarter Report and repeated herein on p. 77, the

DRGs, as opposed to traditional cost centers, organize and collect hospital financial information vertically (i.e., a given DRG consumes resources from laboratory, radiology, pharmacy, nursing, housekeeping, dietary, etc.). As charges, RIMs and other weights are collected and these distributions are updated over time, staff expect to derive continuing guidance from the hospital community itself regarding the appropriate reimbursement treatment to be given to individual DRGs. Although other parties such as physicians (See Quality Section II.C.1.) and planners (See Sections on "Accessibility," II.C.3., and "Implementation," II.C.4.) will also have "votes," the first cuts at the process of establishing reasonable industry efficiency norms should belong to hospital management. The constant updating highlights our assumption concerning the dynamic of this system: that parties will "react" and that the cost distributions will tend to refine themselves and mature over time. This is to be contrasted with the opposite kind of reaction invited by cost-based reimbursement: resistance in the form of the contest described at the outset of this section. (Refer to Charts 20 and 21 for a detailed description of additional Tasks associated with "Economics.")

CHART 20:

Economics

TASK #23: Allocate Equalized Costs to DRG for Sample of Hospitals
TASK #24: Review and Analysis of Costs Per DRG for Sample of Hospitals
TASK #27: Establish '78 Prospective Budget for Sample of Hospitals
TASK #26: Development of NON-DRG Related Reasonable Costs for Sample of Hospitals
TASK #38: Establish '79 Prospective Budgets for All Hospitals

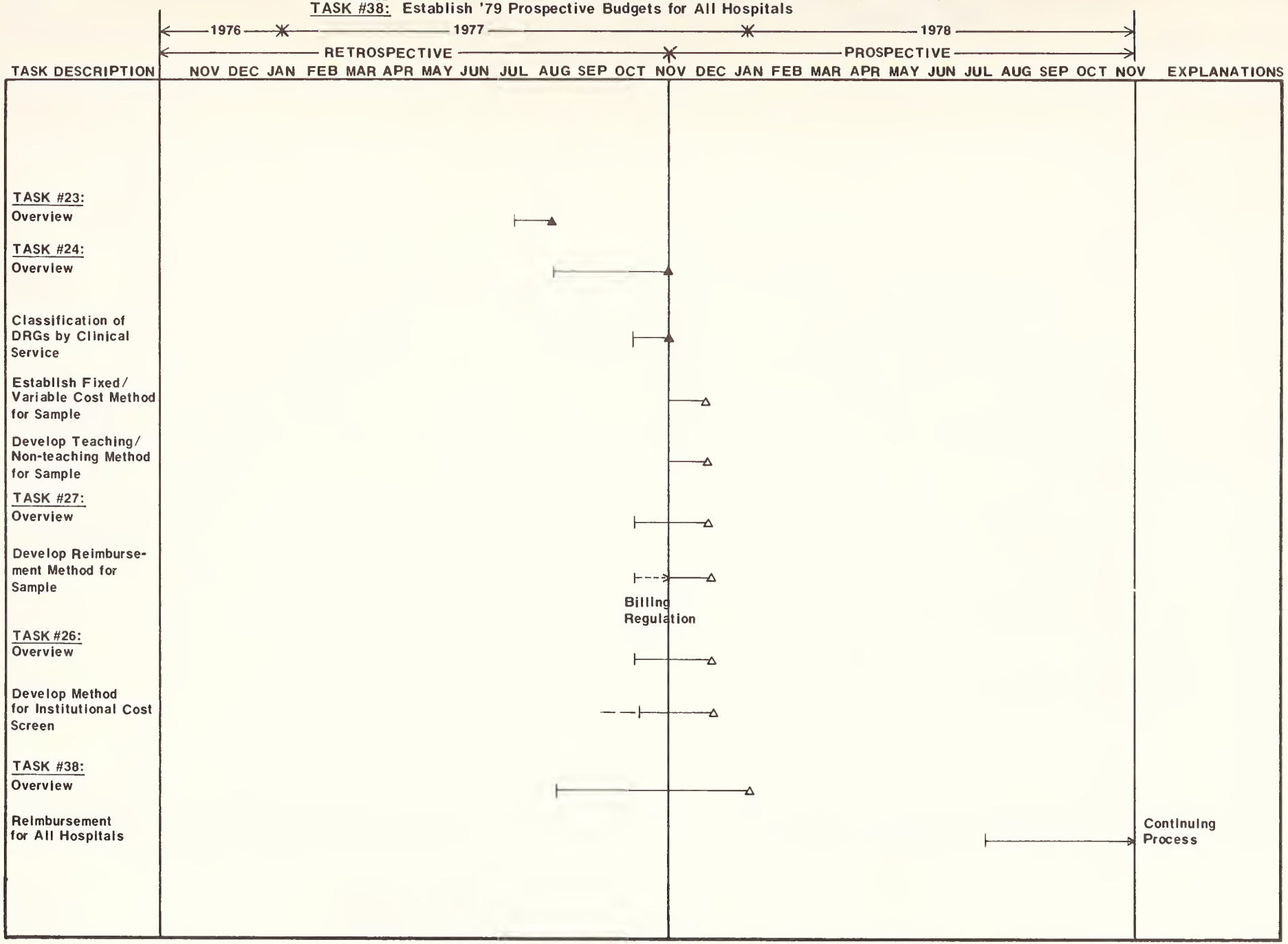
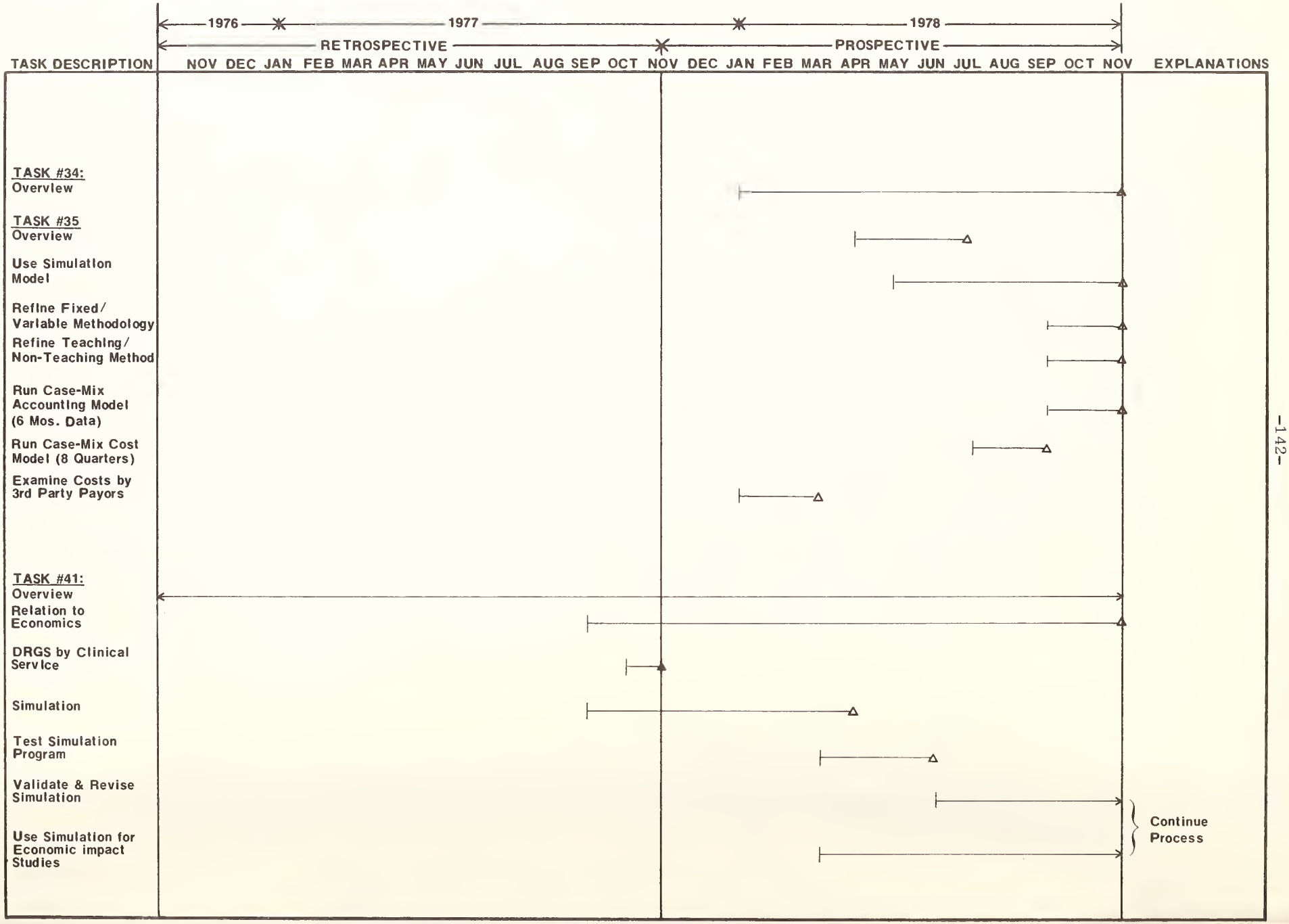


CHART 21:

Economics

TASK #34: Review and Analyze Cost per DRG for All Hospitals – Test Model
TASK #35: Modification of Methodology
TASK #41: Programming



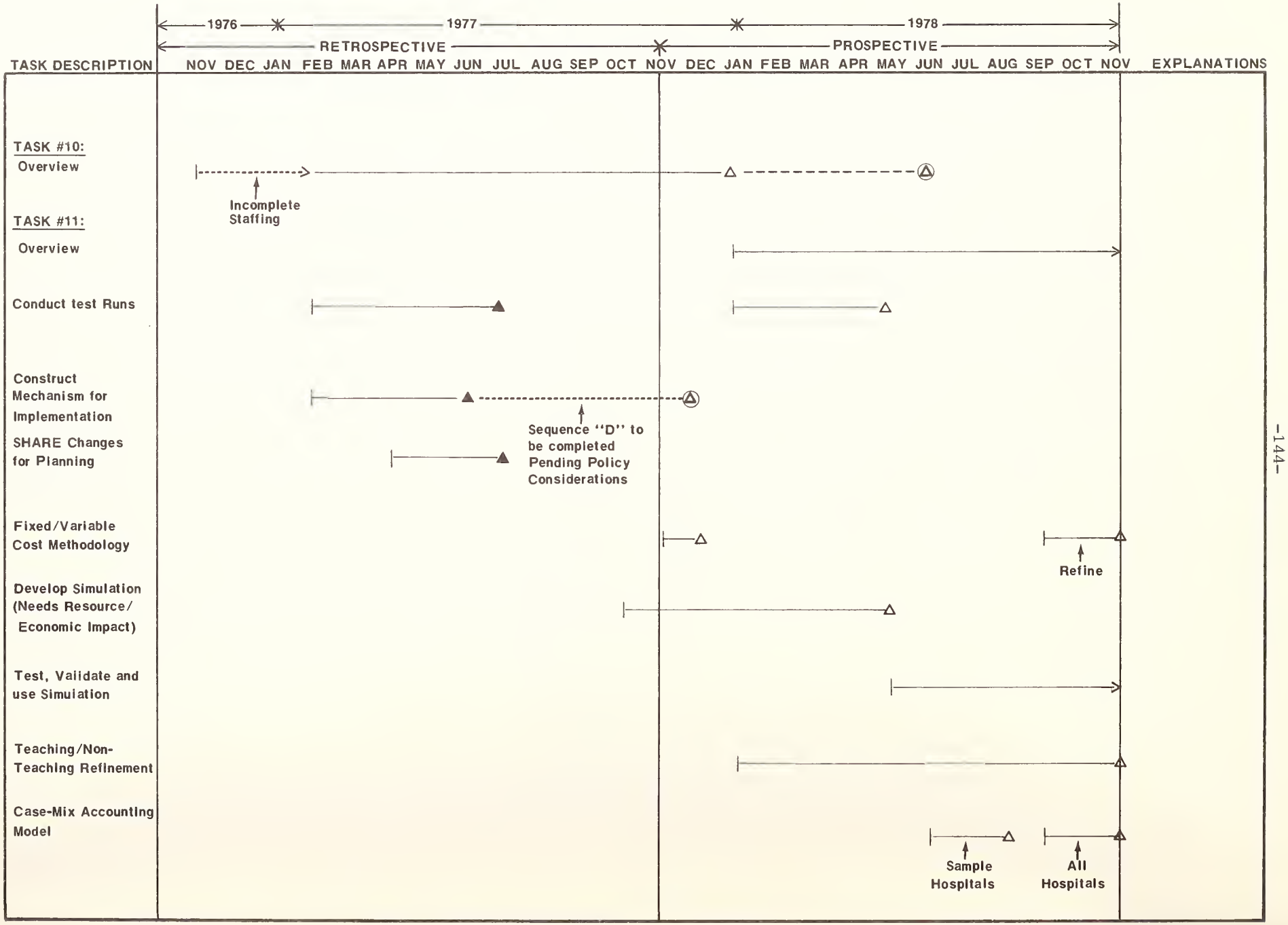
SECTION II

C. Application of Diagnosis Related Groups (DRGs)

3. Accessibility

CHART 22:
Accessability

TASK #10: Development of Planning Screens
TASK #11: Application and Continuing Review of Planning Screens



3. Accessibility

In the preceding sections of this report, emphasis has been placed on the use of DRGs in focusing on issues of cost and quality. For planning purposes, however, a third consideration arises (accessibility), and properly refined DRG data can be of considerable help to the planner. The process of refinement involves reversing the point of view, i.e., identifying in advance the likely mix of needs of a population of potential patients.

Accessibility is a planning consideration which could result in an exception to the rule that all institutions should run at optimal efficiency. A basic example of an accessibility consideration is placing a maximum of 45 minutes of travel time in regionalization regulations for maternity services. A more subtle example concerns the appropriate level of reimbursement to hospitals which retain Medicaid patients when skilled nursing home beds are otherwise unavailable. Considerable work on the latter problem was directed by participants on the Commissioner's Advisory Task Force on Elements of Cost; see particularly the preliminary report of the subcommittee on Appropriate Coverage, Third Quarter Report, Appendix B, Section 1.

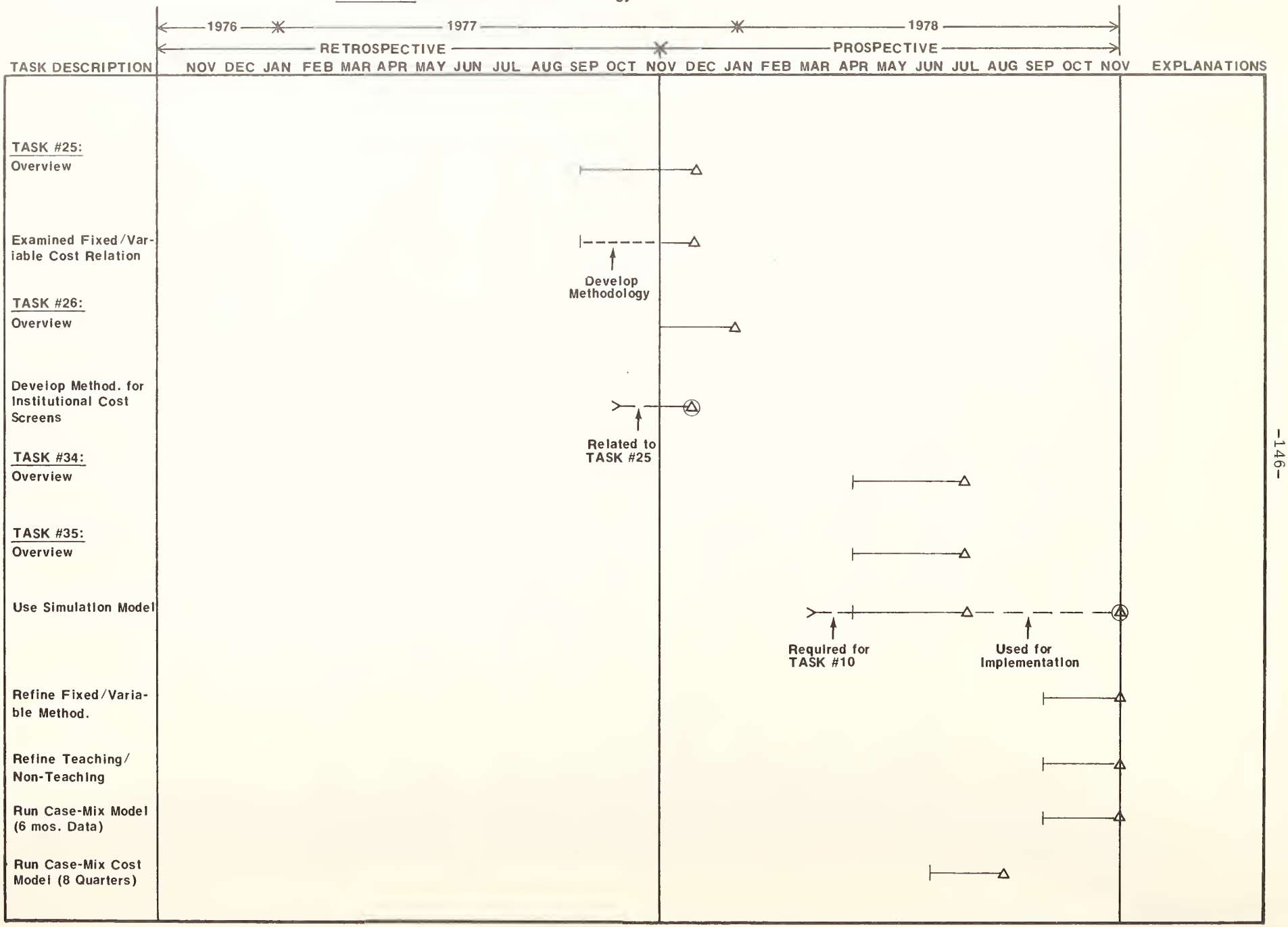
The participation of Health Systems Agencies (HSAs) will be essential when accessibility measures are considered. The HSA has a unique regional sensitivity. For their service area, HSA representatives should be the focus of awareness for consumer demands, institutional missions, and the availability of acceptable alternative services. For this reason, the DRG Project will work with a committee of HSA, PSRO and Department representatives as planning screens are developed.

Planning bodies, such as the HSAs and the State Health Planning and Development Agency (SHPDA), are charged with achieving the delicate balances between cost and access. Staff hope to produce a better understanding of the cost implications involved in electing various mixes of services and facilities (Chart 22 and 23). The techniques are set forth in the next section.

CHART 23:

Accessability

TASK #25: Development of Methodology for Reasonable Cost Screens
TASK #26: Development of Non-DRG related Reasonable Costs for Sample of Hospitals
TASK #34: Review and Analyze Cost Per DRG for All Hospitals – Test Model
TASK #35: Modification of Methodology



SECTION II

C. Application of Diagnosis Related Groups (DRGs)

4. Implementation

4. Implementation

The efforts of the Project staff during 1977 focused primarily on refining the DRG concept and on developing a rate-setting mechanism sensitive to case-mix. During 1978, Project staff will work to shape the DRG classification system so that, in addition to rate-setters, it can optimally serve planners, financial managers, and the medical profession. Each profession views the DRGs in different ways and will want to use the data for different purposes. It is the responsibility of the Department of Health, as the SHPDA, to work with representatives from the HSAs, PSROs, third party reimbursers and providers to determine the best way in which the DRG system can meet the needs of each.

Rate-setters are not alone in the use of the case-mix approach to empirically identify the relative efficiency with which institutions deliver patient care services. This information is significant to the planner and the manager who must determine the appropriate array of services and the optimal configuration of institutions, i.e., the institutional and regional planning described at the outset of the planning section (p. 73). Potentially, DRGs can form the basis for relating institutional planning to hospital financial management, and ultimately, to budgeting and control. Furthermore, DRGs provide the crucial linkage back into utilization of health care facilities and to patterns of medical practice.

By neutralizing the effects of relative DRG treatment complexities, the case-mix approach is able to pinpoint a service that is delivering patient care inefficiently, and consolidation of the service within the region may be indicated. Thus, if a relationship is found between a given quality indicator and volume, or a similar relationship between volume and cost, the State could make a policy decision to establish a single reimbursement corridor for a given DRG, thereby provoding an economic disincentive for low volume hospitals to continue to treat this DRG. Hence, regional referrals would be encouraged.

On the other hand, if institutional (managerial and facility) services are inefficient, this would become apparent by the peer group methodology or variations thereof as discussed in Section II.E. Thus, if an antiquated facility results in inefficiencies, these can be identified and a decision can be made about closing or replacing the physical plant.

The expected mix of cases for specific populations and measures for efficient treatment of these cases reflect a regional planning orientation. This approach will enable the planner to match the medical treatment needs of the population with an efficient mix of resources. A particular example

would be the use that an HMO could make of the case-mix approach in order to fashion efficiency incentives while monitoring quality. (See Appendix I.C.1.)

The Project staff will also study various mathematical techniques for matching health care needs and resources. One technique to be tested is a simulation model. Such a mathematical model would be based upon available data sets and constructed in cooperation with the Health Data Research and Analysis Service. This simulation could include such parameters as each hospital's service composition, target area demographics, resource flow, and alternative health services.

A simulation model also would be valuable for analyses of the impact of capital expenditures and of incentive reimbursement payments. The cost, quality, and accessibility impact on both competing and complementary institutions could be measured. Thus, the model will also provide a long-term view of the distribution of hospital capital expenditures and depreciation. Taking such a long-run view, all hospital costs, whether patient care or institituional, are variable. This will allow a shift from instititional planning for capital replacement or expansion to a regional planning approach to the allocation of capital and resources. Again, the participation of the HSAs will be critical so that a regionally sensitive balance between cost, quality, and accessibility is struck.

The model also could contrast the impact of a DRG-based prospective reimbursement system with the current rate-setting mechanism (i.e., SHARE). Furthermore, the model could be used to simulate the probabilistic result of introducing various incentive payments into the reimbursement system as already suggested. By structuring incentives through such a simulation model, an avenue may be opened towards diverting the allocation of resources from inpatient care to ambulatory services, and ultimately, to preventative health policies and practices.

The planners at the New Jersey State Department of Health have already begun to use the DRG data for information about specialized services that are to be regionalized. (See the Third Quarter Report, Appendix A, Task No. 10 for an example using DRG data on burn patients.) In the future, DRG data will be used to: 1) determine significant variables (utilization, teaching/nonteaching status, etc.) on which quality and cost levels may be dependent, 2) identify services that could be provided more efficiently if regionalized, 3) empirically establish minimum utilization levels by balancing economics, access and quality, and 4) test the validity of norms that have been adopted as service screens.

In a similar way, the HSAs have indicated that the case-mix Project is complementary to their efforts. (See Appendix I.C.6.) The Department has made available to all of the HSAs microfiche copies of the DRG printouts for the first six months of available data. At special request, the Department is also providing to HSA III information on relative lengths of stay related to DRGs by hospital. Furthermore, DRG data can be used as a basis for the periodic review for appropriateness of all institutional services. Under P.L. 93-641, the State Health Planning and Resource Development Agencies share responsibility with the HSAs for this review.

These public regulators will take a multifaceted approach toward rationalizing the use and distribution of health care resources within the State. As a part of this effort, Project staff will examine over the next year several possible means, including regulatory and incentive tools, for implementation of the DRG based planning screens.

a. DRGs and Services

Under Chapters 136 and 138, licensing and certificate of need regulations currently are being used to regionalize services. For example; the State's Health Care Administration Board recently passed Proposed Licensure Standards for Renal Dialysis Services. These standards will be a section of the Department's Manual of Standards for Hospital Facilities which sets independent standards for selected services. Although an institution presently receives one license for the entire facility (with the exception of laboratory services), approval is required for each service. Noncompliance can result in denial of reimbursement for the nonconforming service or revocation of the institution's license with civil penalties. When cost is the primary criteria for determining an inappropriate service, Project staff will look to reimbursement incentives or disincentives as previously described.

At this time, the Department's policy is to issue separate approval for regionalized services to institutions that have received certificate of need for these services and are operating within standards. In addition to renal dialysis, standards have been adopted for hemophilia, perinatal, cardiac surgery, cardiac diagnosis, megavoltage radiation oncology, and computerized axial tomography services. Where appropriate, DRG data will be used to add empirical refinement to these standards. As planning screens for additional services are developed, the potential exists for limiting or expanding the range of services that each institution will provide, thus, truly matching community needs and resources.

b. DRGs and Facilities

Due to the age of many of New Jersey hospitals, population shifts, and changes in hospital utilization levels, the physical location of some of New Jersey's hospitals may no longer be optimally correlated with need. A means for ensuring that existing institutions, if needed in the future, replace themselves only where they are needed is being developed. At the last meeting of the Commissioner's Advisory Committee on Elements of Cost (See Appendix I.C.5.), possible means were discussed; these included reimbursement for depreciation at some percentage of replacement value with the portion of these capital funds placed into a central pool. These central funds could then be used when a Certificate of Need has been awarded to finance construction, renovation, and payment of debts for an institution that wishes to close. Also discussed was the desirability of a decertification law; under curent law, licensing and reimbursement provide alternative avenues to achieve this end. Once again, an appropriate blend of DRG and peer grouping analysis will help to empirically bring this problem to clear focus.

c. Implementation Process

HSA input is as critical to the implementation of planning screens as it is to their development. In addition, the case-mix system of reimbursement must be accompanyied by a strong system of utilization review such as that being developed by the PSROs. As noted, the Project staff is working with the PSROs to determine the mutual benefits that can be obtained from the case-mix approach. (See "Quality," p. 83.) Case-mix data will help to highlight differences in utilization, standards, and the effect of these differences on cost and quality. These could serve as beginning points of inquiry for peer review.

Over the next year of the Project, protocols for HSA and PSRO relationsips will be established.

SECTION II

D. Data Processing and Testing

1. DRG Computer Software

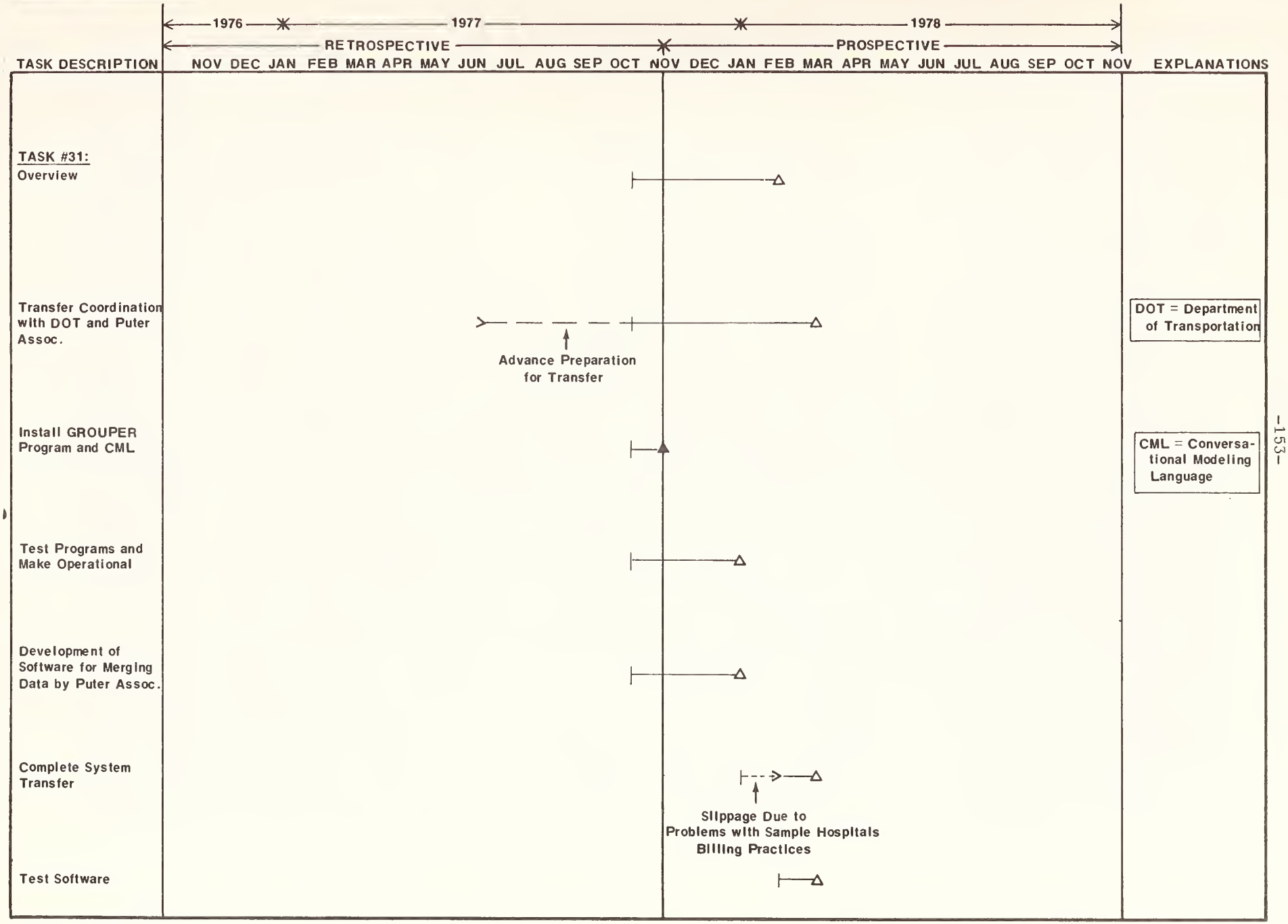
2. Data Processing Progress and Problems

3. Testing the System

CHART 24:

DRG Computer Software

TASK #31: System Transfer from Puter to NJSDOH


1976
1977
1978
RETROSPECTIVE
PROSPECTIVE
TASK DESCRIPTION
NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV
EXPLANATIONS
TASK #31:
Overview
Transfer Coordination with DOT and Puter Assoc.
Advance Preparation for Transfer
Install GROUPER Program and CML
Test Programs and Make Operational
Development of Software for Merging Data by Puter Assoc.
Complete System Transfer
Slippage Due to Problems with Sample Hospitals Billing Practices
Test Software
DOT = Department of Transportation
CML = Conversational Modeling Language

D. Data Processing and Testing

This section deals with general data processing and data analysis issues associated with this Project. Many specific data analysis issues were addressed in the first three sections of this report under their specific problem areas. However, there are several areas of concern general to all or most aspects of this Project. Specifically, this section will deal with: 1) DRG related computer software, 2) progress and problems encountered in data processing, and 3) plans for testing the reliability and validity of the various parts of the reimbursement system being developed.

1. DRG Computer Software

In discussing the DRG case-mix approach mention has been made of several computer programs, i.e., GROUPER and AUTOGRP. These programs, as well as virtually all DRG related software (Software refers to programming elements of computer processing as opposed to "hardware," the physical elements of the computer.) have been developed by Puter and are written in CML (Conversational Modeling Language). Under Task 31, this software is being transferred from Puter to the Department of Transportation (DOT) Data Center, the assigned State data processing center for the Department of Health (DOH). (Chart 24) Once this transfer is complete, all data processing will be assumed by the Department. Basically, the software for prospective reimbursement can be broken down into three main categories: (1) case mix processing, (2) abstract-billing data merge, and (3) Case-Mix Model.

a. Case-Mix Processing

The first step in processing the DRG data is receiving the medical abstract data from the various sources. These data are received on magnetic tape, checked for errors (EDIT programs), and converted to a format common to all data processed. All data with no errors detected are transferred to a tape containing only "clean" data. All data records with an error detected are placed in an "error file" and an "error listing" is produced. The error listings pinpoint the problem and are sent to the proper hospitals for correction. As corrections are received, the affected data records are corrected and re-edited. If the data record then shows no errors, it is merged onto the clean data tape.

The next stage in the process is to use the GROUPER programs to examine the clean medical record data and assign the appropriate DRG. These GROUPER programs, developed under Task 7, take the necessary diagnostic, procedural and age information from each patient's medical abstract and assign the appropriate DRG which becomes part of the computer's data record

for that abstract. There is one GROUPER program for each coding scheme, ICDA-8 and HICDA-2. Listings of these programs are included in Appendix F of the Project's First Quarter Report and Appendix 5-9 of the Project's Second Quarter Report. These GROUPER programs will be revised into a single GROUPER program conforming to the ICD-9-CM codes when they become effective January 1, 1979.

Once this grouping has been done, case-mix reports can be produced for any hospital, combination of hospitals (e.g., HSA area) and for the state as a whole. Also, data tapes can be produced with any arrangement of data. Past data tapes sent to the Department contained records in DRG order or by hospitals grouped by ICDA-8 or HICDA-2 coding schemes and then in DRG order. New tapes produced will be in alphabetical order by hosptial, and in DRG order within each hospital.

The software needed to complete the above processing includes GROUPER, edit and conversion, error update, data merge and report writing programs. All of this software, written in CML, was transferred to the Department of Transportation Data Processing Center (DOT) on October 25. All CML software transferred appears to be operational but tests will be conducted through the end of the year. Appendix I.D.1 contains a memorandum documenting the transfer.

In addition to the transfer of CML and its associated programs to DOT, an Assembler Language version of GROUPER was transferred. This program can stand on its own in the event CML has problems, and is written in a language commonly used by DOT. The Assembler version of GROUPER is needed for the nursing studies during the next quarter since the CML version of GROUPER may or may not be operational in time. This will ensure no delay in processing the nursing studies.

b. Abstract-Billing Data Merge

The next step in processing case-mix data for prospective reimbursement is the merging of billing records for each discharge with their medical abstract. The first step is to receive, edit and convert to a common format the billing data. Once this is complete, and errors corrected, the two data sets are merged using either billing number or medical record number, whichever is common to both records. While this merging process appears easy, since there is a common number on both records, this is not always the case. Problems arise with unmatchable identifier numbers, newborns (See discussion in "Ancillary" section and Appendix I.B.6.), and format identification problems. The latter problem arose with the 1976 data because input from the various sources were not in a similar format. Also, hospitals needed to be contacted repeatedly to clarify problems in reading the data due to a lack of consistency across hospitals.

With the passage of the regulation requiring submission of billing data in a common format, some of the merging problems will disappear. Other problems, such as the newborn problem, are being addressed with the hospitals and other parties (e.g., meetings with the Committee of Participants). The software for editing and converting the billing data, and for merging the bills with the abstracts are currently being written. They could not be written in any unified fashion until the billing regulation was passed and a common submission format established. The software should be completed by February 1978 and transferred to DOT at that time. Parallel runs will be needed (processing the same data at both Puter and DOT) before sole processing responsibility can be assumed by the Department.

c. Case-Mix Model

The Case-Mix Model is basically the process for assigning costs to each DRG in each hospital. There are three key phases to the Model: (1) processing of each hospital's costs, (2) processing of each patient's Measures of Resource Use, and (3) allocation of the costs to the patients.

A detailed discussion of Case-Mix Model processing appears in Puter's Annual Report in the discussion of Tasks 19, 20 and 23 (pages 35-69) (Puter's Annual is attached to this report as Appendix II.A.), and Section II.B.1 of this report. The software for this processing is currently being completed and plans are to transfer the completed software during February 1978.

d. AUTOGRP

One significant piece of computer software not discussed above is AUTOGRP. AUTOGRP does not fit into the above scheme since it operates independently of data processing for rate-setting. AUTOGRP uses on-line data search and analysis capabilities to allow a user to examine data in different ways with little difficulty. The central capability of AUTOGRP is the CLASSIFY command which statistically partitions the data to maximally explain variation in some dependent variable (e.g., length of stay) as a function of some set of independent variables (e.g., patient's age, sex, diagnoses, procedures, etc.). For a detailed discussion of the CLASSIFY algorithm and the other capabilities of AUTOGRP, see Mills, Fetter, Reidel and Auerill (1976)[17] or Theriault, Mills, and Elia (1976)[18].

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17. Ronald Mills, Robert Fetter, Donald Riedel, and Richard Averill, "AUTOGRP: An Interactive Computer System for the Analysis of Health Data." Medical Care, XIV (July, 1976), 603-615.

18. Kenneth Theriault, Ronald Mills, and Eves Elia, The AUTOGRP Reference Manual, Center for the Study of Health Sciences, Yale University (New Haven, 1976).

Through the use of AUTOGRP, statistically significant partitions were established, and those determined to be the most medically significant (physician input) were used in defining the DRGs. Through experience with AUTOGRP, five variables appear to be consistently the most meaningful in accounting for variance in resource consumption: primary diagnosis, secondary diagnosis, primary procedure, secondary procedure, and age. These five variables represent all the information needed to assign a patient to the appropriate DRG. Now that the 383 DRG definitions are established, AUTOGRP is only needed when these definitions become inadequate due to changes in resource consumption patterns (See discussion in Section II.A.4., "Reassessing DRGs.") or if the abstract data needs to be completely repartitioned using a dependent variable other than length of stay (e.g., total allocated costs).

2. Data Processing Progress and Problems

Much of the effort of the last twelve months has been geared toward developing the necessary methodologies for the reimbursement system, and constructing the necessary data elements for this development. As of October 1, 1977 medical abstract data from all hospitals, except Greenville Hospital,* is complete. This includes 63 hospitals using NJUP (New Jersey Utilization Program), 43 hospitals using PAS (Professional Activity Study) and four hospitals with independent abstracts. Total numbers of records submitted for each quarter from each hospital are contained in Puter's Annual Report (Items 2 through 5 under Tasks 2 and 3 in Appendix A).

Numerous problems in processing the abstract data were encountered during all four quarters of this contract. These problems caused delays in almost all tasks directly associated with medical abstract data (i.e., Tasks 2 though 9). The timeline charts for these tasks (Charts 2 through 4) reflect these delays. Some of the problems encountered were: (1) delays in hospitals signing release forms for PAS to submit the data to the Department, (2) a sequence of errors causing repeated rejection of the data from PAS for the third and fourth quarters of 1976 (See items 7 through 15 under Tasks 2 and 3 in Appendix A of Puter's Annual Report for details and documentation of these errors.), and (3) delays in receiving corrections of detected errors in hospitals' data.

As these and other problems are resolved, data should be received and processed by the Department on a regular basis. Data should be received forty-five days after the end of a quarter; data should be edited, converted, grouped, and made available within one month of reception. At this point in time, the problems involved preclude the realization of this schedule.

Case-mix reports have been produced for all hospitals and the State using data from the first two quarters of 1976. Production of the case-mix reports using data from all four quarters of 1976 has been delayed due to the above mentioned delays in processing the medical abstract data. These delays are reflected in the timeline chart for Tasks 8 and 9 (Chart 3).

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* As of January 1, 1977, Greenville Hospital has joined NJUP.

Once the above mentioned medical abstract processing schedule is realized, case-mix reports can be produced on a semi-annual schedule in April and October. The current schedule for case-mix reports using 1977 data is March for the first six months of 1977 and October for the entire year of 1977. In addition to the delays resulting from data processing problems, some delay is expected to result from the transfer of software from Puter to DOT. Delays may result since DOT personnel must become acquainted with new software systems and a new processing language, CML.

The status of data processing for other specific sections of this Project, such as case-mix analyses, the nursing studies, and planning are discussed in their respective areas of Sections B and C. With the assistance of the Department's Data Processing Section (Management Services Unit), data processing within the Department has been operating effectively.

3. Testing the System

Since this Project is heavily empirical in nature, there are numerous steps necessary to ensure the appropriateness of products produced by the Project. There are four distinct issues to address for every empirical aspect of this Project: (1) reliability of the data, (2) validity of the data, (3) validity of the statistical analyses, and (4) quality of the results.

a. Reliability of Data

This area deals with the quality of the measurements made by data gathering instruments, i.e., are the numbers being used consistent? An example of unreliable data are the temperature readings produced by a thermometer which reads 100°C when placed into boiling distilled water at one time and reads 92°C when placed into boiling distilled water another time. If one were dealing with medical abstract data, one could measure reliability by going back to patients' medical records and producing new abstracts. If the data are 100% reliable, all reabstracts would be identical to their corresponding original abstract.

There are numerous sources of unreliability in measurement which potentially affect data used by the Project: (1) human error such as mistakes in coding data (e.g., using the wrong ICD code for a diagnosis), misreading original data documents, forgetting to record certain information, etc., (2) systematic error, errors made in a repeated and reproducible manner (e.g., consistently placing the primary diagnosis in the wrong boxes on a form, consistently placing a hospital charge in a wrong cost center), (3) random error, errors due to unbiased outside sources (e.g., keypunch errors, simple arithmetic errors, outside noise causing a mistake, etc.).

If the data are highly unreliable, then it has no utility. However, if data are slightly unreliable (No data are perfectly reliable.), then this can be taken into account during analysis. Studies have been conducted regarding the reliability of medical abstract data and such a study is currently in progress in New Jersey.* The results of this study will help guide the development of rate screens as a function of each DRG's reliability. (Reliability in abstracts appears to be largely a function of diagnosis.) Reliability of other data sets used by this Project will be examined as the data become available (primarily billing data, nursing studies data, and patient care general services studies data).

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* On December 24, 1975, the Department was awarded HRA Contract No. 230-76-0081 to design and develop the New Jersey Hospital Care Component of the Cooperative Health Statistics System for the National Center for Health Statistics.

b. Validity of Data

This area deals with the question of whether or not the data actually represent the information they are expected to represent. For example, a reliable thermometer with temperature markings in the wrong places would produce reliable (reproducible) temperature readings, but these readings would not be valid.

For most of the data used by the Project, validity will pose little problem as long as the data are reliable. (Unreliable data are also invalid, but not vice versa.) For example, the charge data comes directly from the same source as patients' actual bills. (A computer usually produces both at the same time.) As long as the charges are reliably recorded, they will represent valid data. The same arguments basically hold for medical abstract data and cost data.

Areas where validity will need to be analyzed in some detail are the nursing studies, certain patient care general services studies, and the use of relative value units (RVUs) if hospitals choose to use them instead of charges. (See discussion of RCC vs. RVUs in Section II.B of this report.) These analyses will be conducted as needed and as the necessary data become available.

c. Validity of Statistical Analyses

This area deals with the appropriate employment of statistical techniques in the analysis of the data. Most statisitics make a variety of assumptions about the data being analyzed which need to be met. Statistics also produce specific answers to specific questions. This means that questions to be answered by the data must be clearly stated, and the data must meet the requirements of the question.

An example of an invalid analysis would be to ask, "Who is the most average professional football player currently playing?" and to answer this question by calculating the mean of all players' jersey numbers to find the player with that average number. The data are perfectly valid identifiers of players, but the question is nebulous and the numbers represent no information about players' relative playing abilities.

Questions of the validity of statistical analyses are addressed whenever statistical analysis is employed. The only issue that has proven difficult to date is the use of the ratio of costs to charges (RCC) as the statistic to allocate costs to each DRG.

The problem is that some hospitals argue that their pricing does not follow costs and, therefore, the RCC is not a valid statistic for cost allocation. This problem is actually a

mixture of data validity and analysis validity. There are numerous theoretical arguments in favor of the validity of using the RCC and against the pricing bias argument, but final resolution of the issue can only come with the empirical data to be supplied under the Department's bill reporting regulation.

All statistical analyses conducted for this Project are reviewed for their appropriateness and this type of analysis will become more important as the data gathering problems subside and data analyses can occur more frequently. The activities anticipated under the planning portion of the Project (Section II.C) will require complex statistical analyses, and questions of the complexity of the data relative to the analysis become extremely important.

d. Quality of the Results

This area deals with the question of whether or not the results of a methodology are those desired or most appropriate. For example, AUTOGRP might suggest partitions of a major diagnostic category by age, accounting for 60% of the variance in the length of stay (LOS) distribution, and by surgery or no sugery, accounting for 50% of the variance in LOS. Given this information, the physician may choose to use the surgery/no surgery partition because it was more medically meaningful for the particular group of patients. Even though the statistical methodology would have chosen the age partition due to its somewhat higher percent of variance accounted for, the surgery/no surgery partition would have been chosen since it produced a better quality result.

This type of quality analysis is necessary in a Project such as this since purely statistical approaches might produce undesirable results. This is especially true in planning (Section II.C) where accessibility must be taken into account over purely statistical or economic conclusions. Quality analysis can be applied theoretically (Will the proposed methodology provide the information necessary, or use the information properly, to accomplish the task involved?) and empirically (given the alternatives provided by the methodology, which is the "best," or how must the alternatives be modified to become "best?"). Quality analysis will become more important as methodologies now being developed near completion, and those already developed are implemented. During the next quarter, empirical quality analyses will be needed for (1) the results of the rate-setting Experiment with the 21 sample hospitals, and (2) the results of the three nursing pilots. Theoretical quality analyses will be necessary for a large number of methodologies under development, including the construction of rate screens, planning screens and quality screens, statewide cost allocation methodologies, approaches to dealing with outliers, reimbursement for medical education costs, and many others.

This section has attempted to outline in some detail the specific data processing and data analysis aspects of this Project. The computer technology needed for the Project was discussed together with data acquisition and processing problems. Finally, the criteria being employed in analyzing the data were described.

III. CONCLUSION

A. Summary

Project staff has examined the appropriateness of using two different kinds of methodologies, case-mix and peer grouping, for evaluating costs for reimbursement purposes. Since Diagnosis Related Groups provide a method for classifying patients, it was decided that organizing by DRG those costs which tended to vary with the kind of care required by the particular case (services such as laboratory, nursing and dietary) provided a superior way of viewing these costs. On the other hand, it was decided that peer-grouping (SHARE) continued to provide the appropriate way to compare institutional costs such as administration and plant. An evaluation of the kinds of costs and statistical data which would be required was performed and modifications to both methodologies undertaken to reach this goal: a blend of regulatory tools tailored to meet the unique cost contours of the health care industry.

An evaluation was made of the weakness and limitations in both systems and appropriate steps were taken. In the case of SHARE, cost definitions were clarified to improve both consistency and uniformity. By year end, a manual was composed which detailed the appropriate placement into SHARE cost centers of individual items for which a hospital may charge. With respect to case-mix, the generation of DRGs developed at Yale University was entirely reformed to meet statewide conditions in New Jersey. A process for the continuing refinement of group classification has been established, and a process for appropriately treating outliers, cases which cannot be classified due to aberrant lengths of stay, proposed. Depending on the cause, outliers may represent either an opportunity to refine the DRGs, or a need to change some aspect of the health care delivery system.[19]

Plans to gather the extra statistics required to properly allocate costs were formulated. The most innovative effort concerned the development of weights by which to allocate the costs of nursing to DRGs. After having completed extensive search of past efforts, separate methodologies representing three distinct points of view were proposed: Patient Classification System/Acuity Instrument, Nursing Diagnosis and traditional time-and-motion analysis of nursing performance.

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19. The mere presence of outliers (10.3% of patient days, 1.9% of patients) will become the focus of continuous refinement for the system of classification. Conversely, for example, should particular cases involve unplaced nursing home candidates, a temporary solution may involve reimbursement consideration to the individual hospital. However, any comprehensive solution would require intervention by the planner.

Separate studies to evaluate these approaches are currently in progress and a hybrid methodology employing the strengths of each will be used ultimately to allocate nursing costs. Special mention must be made of the Nursing Screens Advisory Committtee which has provided valuable industry input into the process of development. Their work, however, only exemplifies the contributions of numerous parties includng the New Jersey State Nurses' Association, Nursing Directors' Forum, Nursing Services Administrators of Southern New Jersey, New Jersey Hospital Financial Management Association, New Jersey Administrative Dieticians Association, New Jersey Medical Records Association, New Jersey Chapter of the American Physicial Therapy Association, Hospital Fiscal Officers Group, New Jersey Foundation for Health Care Evaluation, New Jersey Medical Society, New Jersey Health Systems Agencies (HSAs), New Jersey Hospital Association, the New Jersey Association of Osteopathic Physicians and Surgeons, the Committee of Participating Hospitals, and numerous individuals who have all provided critical input. The future importance of this kind of input is discussed in "Issues," Section III.B., which follows.

In addition to these statistics, charge data were required to create a Measure of Resource Use by which to relate the costs of ancillary services to DRGs. A regulation requiring submission by all New Jersey hospitals of the minimum necessary data set was first proposed during the spring and underwent successive revisions at the request of the industry. The changes have been designed to reduce both the inconvenience and expense of collecting this data. After a demonstration to the Health Care Administration Board of the preliminary results set forth in this report, the regulation became law on September 20, 1977. It was subsequently tested in a law suit,[20] and as of this writing, has been upheld by a three-judge panel of the State Appellate Division. Hospitals not explicitly exempted under the provisions of this regulation will submit to this agency "...for each patient discharged a record of the total charges incurred by the patient within an individual ancillary service for each ancillary service cost center defined by SHARE..." beginning with patients discharged on December 1, 1977. (NJAC 8:31-16.17.)

The practical problems which attend the passage of this regulation also have received attention. Discussions aimed at achieving coordination have been initiated with both the providers of data such as processors, hospitals, and State data management, and the users of data which include PSROs, HSAs, payors, and hospitals, as well as this Agency. A program designed to test both the reliability and the validity of the data has been formulated, and hopefully, the development of a low cost quality data base will parallel or precede the application of DRGs as common denominators to other aspects of the health care field.

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20. See Appendix I.E.

The groundwork for the application of DRGs to planning was laid during this year. The Commissioner's Physician Advisory Committee has already begun its exploration of areas where DRGs might provide the basis for an objective evaluation of quality. Discussions of an appropriate relationship by which the utilization and reimbursement activities of the PSROs and this Agency might complement one another proceed. Meetings with HSAs and State planners regarding the use of DRGs for regional and statewide planning purposes already have been held, and case-mix reports for both parties have been generated. The second set of case-mix reports for individual hospitals will be distributed in December.

Finally, efforts continue to bring about parallel progress on substantive matters such as elements of cost. At the Elements of Cost held on October 27, 1977, the full committee began its consideration of various alternatives by which to shift capital resources to wherever they might be needed most. A consideration of the importance of the prospective reimbursement system based on patient case-mix with a complementary regulatory structure follows.

B. Issues

On the 25th and 26th of October, a conference was held at the request of the Department of Health, Education and Welfare to review progress concerning the eight experiments and demonstrations being funded by the Health Care Financing Administration (HCFA). The variety of approaches being tested (for example, the regional Maxicap) helped to underline the concern with which "the rising costs of health care" is viewed by federal authorities. The participants noted the problem of addressing case-mix diversity and various solutions were discussed. New Jersey's Project is centered on case-mix as the basis for developing a prospective rate.

The concept of relating financial data to medical data is obvious in an industry which delivers health care. Although the term "case-mix" was not coined until recently, the concept of paying by the case has its roots in the fee-for-service payment system. Thus, the idea of extending payment by the case to hospitals is simply evolutionary. It is a step which will harmonize hospital reimbursement with what has already happened elsewhere in the industry. Accordingly, the parties here assume a responsibility to learn from history, to find ways to insure that the problems and abuses which have attended fee-for-service payment are not imported into case-mix.

The participants at the HCFA conference gave important insights into the significance of certain problems and their possible solutions. For example, several individuals, particularly the representatives of the Maryland Health Services Cost Commission, made observations concerning the treatment of labor, capital, and the factors which might go into developing meaningful incentives. Labor is that portion of the rate about which management must have maximum flexibility. In order to balance this need with the public interest, management should be allowed discretion to reward productivity. Efficiency norms must be established by first neutralizing wage differentials based on geography (equalization) and then developing benchmarks fair to both the industry and the public. The public is entitled to have care delivered efficiently.

The relationship between productivity and incentives is important. As noted in Section II.C.2, "Health Economics: Cost-Based versus Incentive Reimbursement," Judge Sidney Goldmann found that the uniform application of any flat productivity factor would be unfair to individual institutions. Instead, the factor must recognize and vary with the relative degree of efficiency which each institution has already achieved. The development of case-mix reimbursement will enable us to identify relative efficiency. More importantly, as noted in Section II.C.2, it does this by counting the "votes" of industry management, the 383

distributions of costs organized by DRGs and updated quarterly. The significance is that this represents a unique opportunity for the industry itself to set the basis for developing norms. The industry deserves the opportunity to try this approach before some of the more vigorous controls being contemplated are applied.

The development of rates for the Experiment hospitals is only the first round in the process. As the data are collected over time, both the numbers and the judgments upon which they are based will become more refined and meaningful. For several hospitals, the current quality of the data is such that setting rates may not even be possible. However, for the majority of the Experiment group, the optional DRG rate will represent the beginnning. Therefore, it is both timely and appropriate that assistance and advice be solicitied from the 21 institutions, industry groups, federal authorities, payors, and students of the health care field.

During the month of January, the Department will consult with concerned parties to consider the matters of most immediate concern outlined in this report. For example, in Section II.B.4, Project staff outlined a refined "peer-grouping" approach to treating institutional, as opposed to DRG, costs. It is possible to establish a reasonable prospective global budget for an institution with a certain set of characteristics such as size, location and teaching responsibilities. A refined method for scaling these characteristics is currently being considered. The proper relationship between this approach to institutional costs and the DRG approach to patient care costs must be set in motion. This in turn relates to the proper structuring of the incentives. All of these pieces must be integrated through the development of a complementary system for reporting back to the institution those areas where improvements in efficiency can be undertaken. Only in this manner can management respond to earn the incentive. The system will lend itself to the gradual resolution of this task because 59 DRGs account for over 50% of the discharges.

At the January meetings, the parties also will consider problems of a more practical nature. For example, this Department has already devoted considerable energy to seeing that the information required to run this system reaches us in the lowest cost and most efficient manner. (See Section II.B.1.) By January, Project staff will have had one month of statewide experience in collecting charge data and can begin to sort through a second round of problems based on the feedback. Staff will continue to work with both processors and payors in order to minimize inconvenience to the institutions and maximize the quality of the data.

The January meetings must be devoted to giving this Agency advice concerning reimbursement policy. This emphasis in no way diminishes the dedication of this effort to issues of quality of and access to health care delivery. In fact, although the incentives will be available to all hospitals, the effect of this methodology on rates of reimbursement for individual institutions will be felt strongly only at the extremes, the most efficient and the least efficient. The real virture of using a common denominator is that the concerns of many different parties (e.g., the planner, the doctor and the payor) can be brought to bear on the same unit. It helps to focus diverse points of view on the same matter at the same time. In terms of perspective, the level of detail obtained by viewing costs by the case in the health care field is rather like the difference between a fixed lens Brownie and Nikon with different lenses for different purposes. Although the "DRG rate" to be offered to the participating hospitals in 1978 is purely optional, the January discussions represent the first opportunity for all parties to begin to give shape to an appeal structure which fairly accommodates the new and difficult kinds of questions which payment by the case will ultimately crystallize.

The hopes expressed by the staff for this system of classification are best projected by current work in this area of future development. (See Section II.B.1.) As noted, DRGs can be shaped to meet the needs of different people. With the input of appropriate information and follow-up, it should be possible to identify benefits which patients might receive due to a given course of treatment: to isolate significant variations in life expectancy and patient condition which may result from pursuing one course of treatment in the matter of a given DRG as opposed to others. (Appendix I.E.5.) Although the work of the Commissioner's Physician Advisory Committee has been arduous and difficult, it was surprising to discover how much agreement actually existed among the members concerning the use of certain DRGs as a basis for developing objective quality criteria. The physicians expressed considerable enthusiasm about the opportunities which this system of classification offers to their profession for empirical insights which may some day result in improved patient care.

The reader has been cautioned not to expect too much too soon. There will be no black and white conclusions about the success of DRGs in 1979. They will fail to explain a cetain amount of data, perhaps because of a certain amount of irrationality or bias in the hospital charge structures; perhaps due to a system in which part of the costs are subject to regulation and rate review and part are not. The question of immediate concern, to be resolved in the next two months, is whether or not the combination of charges, RIMs, and weights organized in the manner described in this report points the way sufficiently to permit the setting of reasonable rates. The preliminary results set forth herein are encouraging.

This report indicates that the construction of this methodology is only the first step in a process. As the methodology is used over time by the participants, it will generate more and better information which can be fed back to improve the various aspects of this developing system. In its first year, a certain amount of data will be explained, and correspondingly, the frontiers of ignorance will be pushed back a little.

Certain parties have argued that the process should be retarded while we "pause for a study." One might like to have the luxury of time because it is very easy to study these numbers for years. Yet even the most knowledgeable hospital person, planner or physician should benefit from the process itself of assembling and viewing cost data in this manner. Moreover, the reimbursement aspect of this Project must be viewed in context. Although it is the first piece of the puzzle, and therefore, that piece without which the others may not proceed, it is only one piece of at least three: reimbursement, planning, and quality.

It is not possible to know precisely what this system will look like when it is fully developed. It is not totally clear that it will function as a reimbursement system in its first year of existence. However, every industry, regulated or not, must eventually develop its own set of performance standards based upon common denominators. The New Jersey Project is a significant part of the national effort in this matter; and in that respect the New Jersey health care community has before it an opportunity to begin to shape the future of this industry.

GLOSSARY

Algorithm	Procedural rules or guidelines for solving a recurrent problem in mathematics.
AUTOGRP	An interactive statistical software system which partitions patients' hospital discharge information into homogeneous groups by means of algorithms which explain variations in some dependent variable (e.g., length of stay) based upon the effects of selected predictor variables (i.e., medical diagnoses, surgical procedures, and age).
Case-Mix	The specific types of patients (as defined by primary and secondary diangosis, presence or absence of surgery, and age) treated in a given hospital or group of hospitals.
Charge Data	Information requested from New Jersey hospitals in Sections a and b of Regulation 8:31 - 16.17: Reports to Relate Ancillary Service Charges with Hospital Case-Mix. A list of individual items and procedures charged within an individual ancillary service as well as a total of ancillary, routine, and miscellaneous charges incurred by each patient discharged.
Class I Hospital	Any New Jersey hospital which possesses or utilizes on electronically assisted data processing system for patient billing, thus able to submit to the Department of Health patient charge information in a computer processable input medium by February 28, 1978 as required by New Jersey Regulation 8:31 - 16.17: Reports to Relate Anicllary Service Charges with Hospital Case-Mix.

Class II Hospital	Any hospital in New Jersey which, because of unique characteristics, will be unable to submit charge data by February 28, 1978 as required under Regulation 8:31 - 16.17.
Class III Hospital	Any New Jersey hospital which neither possesses nor utilizes an electronically assisted data processing system for patient billing, and is thereby unable to submit billing data until mid-1978.
"Clean" Data	Data which either contain no detectable errors or data which have been systematically screened, corrected, and prepared for electronic data processing.
CML	Conversational Modeling Language; a computer programming language developed at Yale University, New Haven, Connecticut which is used to construct the Grouper and AUTOGRP algorithms.
Commissioner's Physician Advisory Committee for Quality Development	An interdisciplinary specialty panel of physician consultants assembled by the Department of Health to develop process and outcome indicators of quality from medical discharge abstracts. These indicators will be instrumental in the development of corridors for reimbursement.
Computer Hardware	Machinery used to input and process data.
Computer Software	Programs (i.e., instructions) inputted to direct the computer processing of data.
CSS	Central and Sterile Supply cost center as defined under the SHARE system.
Data Base	A collection of computer processable information stored on a computer accessable medium (e.g., medical abstract information for every patient discharged in 1976 and stored on magnetic tape).

Disk	A computer accessable medium for storing large amounts of information.
Diskette	A computer accessable medium for storing large amounts of information. These are usually linked minicomputer systems.
DOH	New Jersey State Department of Health
DOT	New Jersey State Department of Transportation
DRG	Diagnosis Related Group. A class of patients grouped according to characteristics such as primary diagnosis, secondary diagnosis, age, surgical procedure, and other complications which exhibits a consistent amount of resource consumption as measured by some unit (e.g., patient days, dollars, etc.).
Dx	Diagnosis
File Specifications	Specific description of the order (format) in which data is to be submitted to the Department.
Grouper	Computer programs used under the AUTOGRP system to assign patients to DRG categories using medical abstract data.
HCAB	Health Care Administration Board. A body of 13 Governor appointed members representing medical and health care facilities, labor, industry, and the public, whose function is to approve rules and regulations promulgated by the New Jersey State Department of Health.
HES	Health Economics Services. A program of the Division of Health Planning and Resources Development under which the DRG Project is located.

HICDA-2	Hospital version of the International Classification of Diseases, Adapted for America - 2nd Edition. A coding scheme currently used for identifying diagnoses and procedures.
HSA	Health Systems Agency. A group of regional health planning organizations which, through authority granted by federal legislation, has the authority to develop plans for certain institutional health care capital expenditures in a particular geographical area.
ICDA-8	International Classification of Diseases Adapted for America - 8th Edition. A coding scheme currently used for identifying diagnoses and procedures.
ICD-9-CM	International Classification of Diseases - 9th Edition - Clinical Modifications. A coding scheme for identifying diagnoses and procedures. ICD-9-CM will replace both ICDA-8 and HICDA-2 on January 1, 1979.
Info Med	Independent hospital data processing firm.
Lognormal	A logarithmic function which has a normal distribution.
Mapping	The assignment of hospital charges to SHARE cost centers where the expense associated with the charge has been reported under the SHARE system.
Measure of Resource Use	An indicator of the amount of consumption of hospital patient care and general patient care services expressed as a Ratio of Costs to Charges (RCCs), Relative Value Units (RVUs) or Relative Intensity Measures (RIMs).
MECCS	Management Engineering and Cost Control Service; a branch of the American Hospital Association and Hospital Research and Educational Trust.

Medical Abstract	A computer accessible form generated in the hospital's medical records department which includes pertinent medical and demographic facts about each patient.
Major Teaching	One of many peer-groupings used by SHARE for analysis and comparison of functional costs. This category includes hospitals which have at least two AMA/AOA residency programs and more than one resident per eight licensed beds.
New Jersey Experiment II	Pilot project conducted during 1977 which involved the application of the DRG methodology to derive a prospective 1978 rate for 21 sample hospitals.
NJHA	New Jersey Hospital Association
NJUP	New Jersey Utilization Program. A medical Abstract service sponsored by the New Jersey Hospital Association.
Nursing Diagnosis	A judgement or conclusion regarding a patient's level of health. A Nursing Diagnosis is derived by the professional nurse through an on-going evaluation of subjective and objective data.
Outliers	Patients who, when placed into a given DRG according to the characteristics used by the AUTOGRP system, exhibit a significantly higher or lower amount of resource consumption (as measured in terms of patient days) compared to the rest of the patients in the same DRG.
PAS	Professional Activity Study. National medical abstract service provided by the Commission on Professional and Hospital Activities, Ann Arbor, Michigan.

Prospective Reimbursement System	Method of reimbursing hospitals which projects anticipated expenses for the year ahead and sets a payment rate based on this projection.
PSRO	Professional Standards Review Organization. A Program mandated by federal legislation which, through a group of regional organizations made up of professional and lay members, has the responsibility of evaluating and monitoring quality of patient care rendered to patients covered by federal reimbursement programs.
Q-sort	A sorting procedure developed by social scientists during the 1930's by which statements, adjectives, or objects are ordered by rank forcing responses or judgments into a pre-established distribution. As used in this report, a variation of the traditional Q-sort was used by nurses to rank DRGs by intensity of nursing services in treating the typical patient per diem per DRG.
Recasting	The reclassification of costs into accounts that correspond to SHARE's functional reporting system.
RIM	Relative Intensity Measure. A Measure of Resource Use which is a substitute for nursing service charges. A RIM reflects the amount of nursing services by skill level by DRG.
Screens	Minimum and maximum criteria required to evaluate elements related to the development of a cost per DRG (i.e., health planning, quality of care, and costs incurred prior to the year for which a prospective budget is being established).

SHARE	Standard Hospital Accounting and Rate Evaluation System. The cost reporting peer group system currently used for hosptial rate-setting in New Jersey.
SHARE Cluster Level	A grouping of hospital functional cost centers used by New Jersey's rate-setting program to develop categories for comparisons between hospitals.
Simulation	As used throughout this report, simulation refers to a computer model of key elements of New Jersey's health care system and other interacting systems.
SMS	Shared Medical Systems. Independent Hospital data processing firm located in King of Prussia, Pennsylvania.
Statistical Significance	As determined against chance, a statistical probability statement that a given empirical relationship or attribute actually exists in a population under study.
Step-Down Methodology	System of allocating overhead costs to direct cost centers using some common unit of measurement (e.g., square feet, hours of services, etc.).
Tymshare Medical Systems	Independent hospital data processing firm located in Mahwah, New Jersey.

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